Transparency, Political Conflict, and Debt*

Roberto Pancrazi †
University of Warwick

Lorenzo Prosperi‡
Toulouse School of Economics
Prometeia

July 3, 2018

Abstract

In this paper we argue that an important and not-yet analyzed determinant of the observed heterogeneity of government debt across countries is the interaction between political conflicts and transparency of institutions. In the empirical part of the paper we show that whereas these two variables, *per-se*, are not a significant determinant of observed debt levels across countries, their interaction is a key factor to explain debt-levels heterogeneity. Specifically, political conflicts imply higher borrowing only in non-transparent economies. In the theoretical model we propose a rationale for this effect. When the incumbent has preferences over distribution of resources across different groups, in a transparent economy political uncertainty leads to precautionary savings. Nevertheless, assuming that in more non-transparent economies the probability of an incumbent to be re-elected is more strongly a function of current economic conditions, then political uncertainty leads to borrowing incentives. We structurally estimate the two frictions in our model (political conflict and lack of transparency) by using their macroeconomic implications. Then, we compare the estimated frictions with the proxies for political conflict and lack of transparency in the data and we find a significant relationship, which supports our theory.

JEL Classification: E2 - F41 - D72

Keywords: Sovereign Debt, Quality of Institutions, Saving decision, Political uncertainty.

*We thank Patrick Fève, Christian Hellwig, Martí Mestieri, Nicola Borri, Michel Le Breton, and Robert Ulbricht for the useful suggestions. All remaining errors are ours.

†University of Warwick: R.Pancrazi@warwick.ac.uk

‡Toulouse School of Economics, Prometeia: lorenzo.prosperi@tse-fr.eu

1 Introduction

> *"We all know what to do, we just don't know how to get re-elected after we've done it".* Jean-Claude Juncker, Luxemburg prime minister, *The Economist*, 2007.

The macroeconomic literature has largely investigated the cross-country heterogeneity of macroeconomic variables, especially considering business cycle statistics, namely the variability of output, consumption, investment, and interest rates;[1] however, the heterogeneity and the determinants of debt dynamics across countries is a much less examined issue.[2] In this paper we argue that an important and not-yet analyzed determinant of debt incentives is the interaction between political conflicts and transparency of institutions. The rationale behind this effect stems from the way these two variables affect strategical political incentives to borrow.

Our contribution is both empirical and theoretical. First, from an empirical point of view, we analyze how our two institutional variables of interest, namely *political conflicts* and *lack of transparency*, affect observed public debt for a rather large number of open economies. We focus on these two variables for the following reasons. Political conflicts aim to capture the degree of disagreement within a country, which affects the opportunity cost of not-being elected. We proxy political conflicts with measures of fractionalization within a country, as supported by a large body of research.[3] In a nutshell, in our paper political conflict captures how much at stake there is in an election. Our second variable of interested is *lack of transparency*, which aims to capture the difficulties for voters to recognize the true ability of policy makers, and, therefore, their propensity to base their electoral preferences on recent economic performance. This effect could arise for several reasons: for example, governments might lack of transparency in communicating their policies; also, corruption might affect policy makers' credibility; especially in emerging and developing countries governments might restrict the freedom and independence of the media and, more generally, freedom of expression

[1] The literature about the cross-country variations of business cycle statistics is large: a line of research argues that business cycles in emerging countries can be explained well using a neoclassical model driven solely by shocks to total factor productivity (for example, Aguiar and Gopinath (2007)). Others have explained cross-country heterogeneity with the presence of frictions (financial friction as in Garcia-Cicco et al. (2010), labor market friction in Boz et al. (2012)). Finally, another branch of the literature have investigated the relationship between the main features of business cycles and the institutional and structural characteristics of countries (for example Altug et al. (2012)). This paper is related to the latter line of research. See Uribe (2013) for a more complete review.

[2] See Semlali (1997).

[3] According to Easterly and Levine (1997) ethnic diversity tends to slow growth by making more difficult to agree on the provision of public goods and policies. Alesina et al. (2001) argue that fractionalization is relevant in explaining the diversity of public policies in the US and in Europe. They argue that European countries are more generous to the poors relative to the US as a result of racial heterogeneity in the US and American political institution.

is not guaranteed. Similar restrictions impedes information acquisition and transmission from the side of the voter and his ability to identify the true policy maker type.[4]

Our main empirical result shows that, whereas *political conflict* and *lack of transparency*, *per-se*, are not a significant determinant of observed debt levels across countries, their interaction is a key factor to explain debt-levels heterogeneity. To test this hypothesis we perform cross-country regressions of debt-to-gdp data using our proxies of *political conflict* and *lack of transparency*. Our sample includes 66 countries that are strongly heterogenous in terms of economic development: we have included OECD economies, emerging economies, and developing economies. Our findings can be summarized as follows. First, the simple regression of debt levels on political conflict and lack of transparency yields non-significant (but positive) coefficients: this means that political conflict, per-se, does not contribute significantly to increasing debt. Second, and more importantly, when we add an interaction term between the two variables, the interaction term is positive and significant, while the coefficient associated to political conflict changes the sign and become negative. This implies that if political conflict increases in a transparent economy (low lack of transparency values), its effect on debt is negative (which means it incentivizes saving); on the contrary, in a non-transparent economy (high lack of transparency values) large political conflicts induce borrowing (more debt). To give an example, consider a country with a value of political conflict close to the mean of our sample, such as Brazil. If that country had a very low lack of transparency value (very transparent), the effect of conflict on debt would be negative (thus, inducing savings). If that country instead had a high level of lack of transparency (non-transparent), the effect of conflict on debt would be largely positive, thus inducing borrowing. Third, the significant role of the interaction term is a very robust feature, which holds when adding additional control variables and to a more complete second order regression.

The rationale behind this findings stems from the following intuition. As pointed out in Shi and Svensson (2006), when governments might have unobservable characteristics, in non-trasparent economies voters must rely simply on economic conditions as a possible signal about the quality of the government. The incentives to bust economic condition by using of public debt is a function of the opportunity cost of losing elections, which relates to the degree of political conflict. In a transparent economy, inflating economic performances via debt is not beneficial since voters can disentangle this effect from the true ability of the government. On the contrary, when the economy is non-transparent, voters might be more likely to show

[4]As suggested by Rogoff and Sibert (1988), the existence of information frictions on the ability of the policy maker implies voters will make decisions according to the state of the economy (c.d. retrospective voting behaviour), as a result of a signal extraction game between voters and politicians.

support to the current government if the country enjoys larger amount of resources, thus increasing incentives to borrow for the incumbent.

In our theoretical contribution, we propose a rather simple model that can explain our empirical findings. The starting point is a conventional open-economy real business cycle model similar to Uribe and Yue (2006): an economy is endowed with an exogenous and persistent stream of output and the incumbent makes intertemporal decision on debt to smooth consumption over time. The interest rate the country pays is a function of the debt level. We add political uncertainty into this model: in each period the incumbent has a certain probability to be re-elected. In addition, we include also political conflict and transparency. Regarding political conflict, similarly to Alesina and Tabellini (1990b), parties have preferences over distribution across different groups and decide the allocation of consumption according to these preferences. A single parameter, which we refer to as the degree of political conflict, determines how unequally the incumbent would like to split aggregate resources. The higher is the degree of political conflict, the larger are the benefits from being in power.[5]

We emphasize that when political uncertainty is characterized by a constant probability to be reelected, political conflicts *per-se* are not necessarily able to produce borrowing incentives. For example, when the incumbent has Constant Relative Risk Aversion (CRRA) preferences with risk aversion coefficient greater than one, political uncertainty and political frictions alone, i.e. in a transparent economy, induce precautionary savings. In fact, under these preferences, the incumbent would like to transfer resources from her incumbent-state to a possible future opposition-state, thus leading to incentives to postpone consumption. This feature is consistent with our empirical result that political conflict, in a transparent economy, has a negative sign on its relationship with debt.

Then, we introduce the feature of *lack of transparency*. We assume that in non-transparent economies, the probability of an incumbent to be re-elected is more strongly a function of current economic conditions.[6] Empirical studies, such as Pacek and Radcliff (1995), Lewis-Beck and Stegmaier (2000), and Bartels (2013), support the notion that economic performance

[5]We believe that the assumption on political frictions operating through redistribution of resources is realistic. There is broad evidence that economic inequality is also related to conflicting preferences over redistribution especially in countries where ethnical heterogeneity is large. Finally, Horowitz (1985) studies several cases where the strong relationship between ethnicity and redistribution is evident, thus concluding that: *"In much of Asia and Africa, it is only a modest hyperbole to assert that the Marxian prophecy has had an ethnic fulfilment"*. Donald L. Horowitz, 1985.

[6]Our reduced-form way to model lack of transparency can be justified by the concept of retrospective voting, as introduced by Nordhaus (1975), in which voters myopically reappoint the incumbent conditionally on current economic conditions, and then extended in Rogoff and Sibert (1988) and Rogoff (1990), which rationalize this behaviour in a rational expectation model by means of a multidimensional signalling game, where parties have time-persistent preferences and voters try to extract the competence of the incumbent by observing economic conditions.

is a crucial determinant of electoral outcomes and political approval. In our model we show that political conflict *together with* retrospective voting induces borrowing incentives for the incumbent. Intuitively, when the electorate is particularly sensitive to economic conditions, an incumbent is willing to borrow in order to increase current consumption to gain political advantage against the opposition.

Finally, we bring the model to the data. We use the theoretical predictions of our model on a set of observable macroeconomic and political variables to estimate both the degree of transparency and political conflict that are able to match these moments. Recall the two main theoretical findings: first, without lack of transparency, stronger political conflict lead to larger *saving* incentives; second, when lack of transparency is instead high, stronger political conflict leads to larger *borrowing* incentives. These predictions have effects on average debt, average length of government spells, consumption variance, and trade-balance variance. Therefore, we make use of these predictions to structurally estimate the degree of transparency and political conflict for each country that it is able to make these model predictions as close as possible to their observed counterpart. This strategy yields a cross section set of estimates for our two parameters of interest, the degree of political conflict and lack of transparency. Notice that we use only observed macroeconomic moments to estimate these frictions, without using any information about the observed degree of these frictions. Hence, the second natural step is to investigate how our estimates correlate, in the cross-section, with observed proxies of political conflict and lack of transparency. Our finding can be summarized as follows. First, the model strongly support the existence of these frictions. Second, the estimated frictions positively and significantly relate to their data counterparts. Third, once one takes into account possible sources of bias, coming from observing imperfect measures of the frictions and from estimating the frictions with a stylized model that might ignore important effects, the positive relationship becomes even stronger. Hence, we are confident that the mechanism proposed in our model can rationalize the empirical importance of the interaction between political conflict and lack of transparency as observed in the data.

The structure of the paper is as follows. In section 2 we validate the main theoretical results on the cross section of debt to gdp across countries. In section 3 we present our model and the political economy environment, In section 4 we describe the estimation strategy. In section 5 we test the relevance of our model. In section 6 we present the final remarks.

2 Transparency, Political Conflict, and Debt

Two are the most important variables in our analysis: *lack of transparency* and *political conflict*. The goal of this paper is to show how these two variables interact with public debt in the data, and then to provide a theoretical explanation for that interaction using a model.

2.1 Lack of Transparency

In our empirical analysis we measure *lack of transparency*, henceforth simply *transparency*, in a given country using a weighted average of two different proxies. See Appendix A for a description of the data sources. The first proxy is the variable *Functioning of Government (FOG)*. This variable examines to what extent the freely elected head of government and a national legislative representative determine the policies of the government; if the government is free from pervasive corruption; and if the government is accountable to the electorate between elections and operates with openness and transparency. Countries are graded from the worst to the best. The second one is the variable *Freedom of Expression and Belief (FEB)*. This variable measures the freedom and independence of the media and other cultural expressions; the freedom of religious groups to practice their faith and express themselves; the academic freedom and freedom from extensive political indoctrination in the educational system; and the ability of the people to engage in private (political) discussions without fear of harassment or arrest by the authorities. Countries are graded from the worst to the best.

The first proxy is a measure of transparency and credibility of the government, while the second is a measure of information transmission and acquisition from the side of the voters. Our benchmark measure of *transparency* is the equally weighted average of the inverse of the two proxies: $Transp = \frac{1}{2}\frac{1}{FOG} + \frac{1}{2}\frac{1}{FEB}$. Therefore, the higher is the value of this variable, the worst is the transparency in that country.

2.2 Political Conflict

The second variable of interest is *political conflict*, henceforth simply *conflict*. The existence of a conflict between individuals or groups in a given country generates different distribution of aggregate resources benefitting the group in power. Measuring this type of conflict is not straightforward from the data. Following Easterly and Levine (1997) we proxy this conflict using ethnic, linguistic and religious fractionalization. Fractionalization expresses the probability that two randomly selected individuals from the population will not belong to the same ethnic/linguistic/religious group. The existence of different groups per se does not

implies that a conflict in the economy exists, but it is strongly correlated with it.[7]

2.3 Transparency, Political Conflict, and Debt

In this section we investigate whether *political conflict* and *lack of transparency* are important determinants of the level of debt observed in a country. We show a novel finding, not yet highlighted in the literature: whereas these two measures do not have a significant impact, *per-se*, their interaction is an important driver of debt accumulation. In fact, we find that countries in which both political conflict and lack of transparency are high tend to accumulate larger levels of debt. However, in more transparent economies, the larger degree of political conflicts leads to more savings. To test this hypothesis we perform cross-country regressions of debt-to-GDP data using our proxies of political conflict and transparency. Specifically, we estimate the following regression:

$$D_i = \kappa_0 + \kappa_1 Conflict_i + \kappa_2 (Conflict_i * Transp_i) + \kappa_3 Transp_i + \kappa_J X_{J,i} + \epsilon_i, \qquad (1)$$

where D_i denotes the average level of debt-to-GDP level of country i in our sample; $Conflict_i$ is the proxy of political conflict; and $Transp_i$ is the proxy of lack of transparency, as discussed in the previous section; $X_{J,i}$ denotes possible additional regressors; and ϵ_i are regressor errors that are assumed to be independent and identically distributed. Our sample covers the period 1981-2010. A detailed description of data sources can be found in Appendix A.

The measure of lack of transparency has been rescaled to belong in the interval $[0, 1]$. Hence, a country with value of transparency equal to zero is the most transparent (Australia), whereas a country with value equal to one is the least transparent (Swaziland). The measure of political conflict has been rescaled to belong in the interval $[0, \frac{1}{2}]$, to be consistent with the range of values that this variable can assume in the model we present in the next section. Summary statistics of debt, political conflict and transparency are provided in Table 1.

Results are reported in Table 2. In regression (1) we report the estimates of the coefficients of the univariate relationship between debt and political conflict. Without any other

[7] Alesina and Drazen (1991) argue that a war of attrition between interest groups can postpone macroeconomic stabilization. In Alesina and Spolaore (1997) a public good like a school brings less satisfaction to everyone in an ethnically diverse situation because of the different preferences for language of instruction, curriculum, location, etc. So less of the public good is chosen by society, lowering the level of output or growth. The data of "The Minority at Risk project" collects information on ethnic groups that are under threat from national governments. According to the evidence extrapolated from this data african countries, where ethnic fractionalization is the largest, have the largest share of the population consisting of' "minorities at risk". According to Easterly and Levine (1997) this implies that groups alternate in power and each group is at risk when it is out of power. They show that ethnic fractionalization is positive correlated and significant with the proportion of minorities at risk

Table 1 – Summary Statistics of benchmark variables

	Debt, D_i	Political Conf, $Conflict_i$	Transparency, $Transp_i$
Min	0.1284	0.0104	0
1st. quartile	0.3263	0.0951	0.0417
Median	0.5112	0.1574	0.2083
3rd. quartile	0.7083	0.2289	0.4583
Max	0.3693	0.4202	0.9167

explanatory variable, the sign is positive but not significant. This means that political conflict, *per-se*, does not contribute significantly to increasing debt. In regression (2) we add lack of transparency: the coefficient associated to this variable is positive and significant, but notice that even when adding this regressor political conflict is still positive and not significant. In regression (3) we first test the mechanism proposed in this paper: compared with regression (2) we have included an interaction term between political conflict and transparency. The interaction term is positive and significant, while the coefficient associated to political conflict changes the sign and becomes negative. This implies that as political conflict increases the effect on debt is negative (which means it incentivizes saving) in a transparent economy (low lack of transparency values), while large political conflicts induce borrowing (more debt) in a non-transparent economy (high lack of transparency values). To give an example, consider a country with a value of political conflict close to the mean (0.2, Brazil). If that country had a lack of transparency equal to zero (very transparent), the effect of conflict on debt would be negative (thus, inducing savings) and equal to -0.53. If that country instead had the maximum level of lack of transparency (non-transparent), the effect of conflict on debt would be positive (thus, inducing borrowing) and equal to 1.55.

The results are robust to using different specifications and adding controls.[8] In regression (4) we also include additional regressors that have been shown in the literature to be important determinant of debt levels. Variable *Credit* is "domestic credit provided by the financial sector (% GDP)". This is a proxy of the soundness of the financial system: when this proxy increases, the government can borrow more easily from national and foreign investors. Its sign is positive as expected, since a more developed financial system makes easier for government to borrow in international markets. *Energy* is measured as energy production per capita: countries that produce energy do not need to rely on international energy markets to satisfy energy demand. The coefficient associated to *GDP per capita* tells that governments of richer countries usually have lower incentive to borrow. The variable *Growth*, which measures annual growth rate

[8]To overcome potential endogeneity issues, all control variables are included in the regression as first available observation in the sample.

of GDP per capita, has also negative effect on debt, countries that grow faster have more resources to finance public expenditures. *Majoritarian* is the fraction of years in our sample in which the country had a majoritarian system. According to Milesi-Ferretti et al. (2002) the existence of a majoritarian electoral system has an impact on fiscal policy. *Openness* is computed as export plus imports over GDP at constant prices. Its positive coefficient might stems because more open country are also more financially integrated. *Pop>65* measures the percentage of the population over 65 years old, this is a proxy of public spending in social security. The positive sign captures the fiscal distress generated by largest pension systems.

In regression (5) we included additional squared terms to control for additional non linearities. In this case also political conflict is significant with negative sign. Given the quadratic terms it is not immediate to observe the change in sign of the effect of transparency. Doing a similar example as before, in this case a country like Brazil (Political conflict similar to the average and equal to 0.2), would experience a negative effect of political conflict on debt, equal to -0.59, if its transparency value were zero, and a positive coefficient, equal to 1.33, with the highest transparency value. In regression (6) we specify the model as in regression (4) adding squared terms of Political conflict and Transparency. In model (7) we have included continent dummies to the regression to control for a "latitude effect". Regression (8) only differs from (7) in the way how the proxies are calculated. While in all the other cases each variable enters as the first available observation for each country in the estimation sample, here the variable is calculated as an average in the reference period. In this way average GDP growth becomes more significant in the regression, but the interaction term is still strongly significant. Regression (9) has the same specification of model (6) but we restricted the dataset to developing countries. Interestingly, our results appear stronger in this case. The size (in absolute value) of the coefficient associated to political conflict, transparency and their interaction is larger. Furthermore political conflict becomes now significant. Model (10) differs from model (7) just for the dependent variable: debt-to-GDP ratios are calculated from 1990 onwards to restrict the sample to the period where emerging markets started integrating in the global economy. Also in this case the coefficients associated to our variables of interests are robust in size and sign. Finally, models (11) to (13) differs from model (7) only for the choice of lack of transparency index used in the analysis. The results seem to be robust to the choice of the transparency index: in regression (11) transparency is defined from "Functioning of Government" described above, while in regression (12) we used "Freedom of Expression and Belief". Finally in model (13) we define transparency as the average of 7 different proxies, including 5 additional proxies to our benchmark definition of transparency. In particular we have also included proxies of freedom of the press and pressures over media content exerted by

politics, state laws or more generally influence coming from the economic environment of the media. We have also included a measure of political participation (that measures the right of people to freely organize in political parties), and a measure of rule of law (as a measure of reliability of the judiciary system). Interestingly the results are very robust to the definition of transparency that is been used.

Table 2 – Transparency, Political Conflicts, and Debt

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Constant	0.47***	0.42***	0.54***	0.25	0.68***	0.3			1.08**				
	(7.16)	(6.1)	(7.79)	(0.49)	(5.95)	(0.57)			(2.47)				
Interaction			2.27***	2.14**	2.1***	1.91**	2.43***	2.48***	3.38***	2*	2.23**	2.25**	3.07**
			(2.99)	(2.22)	(2.92)	(2.05)	(2.67)	(3.9)	(4.05)	(2)	(2.55)	(2.54)	(2.41)
Political Conflict	0.35	0.25	-0.53	-0.4	-2.32*	-2.21	-1.61	-2*	-4.83***	-0.96	-1.36	-1.54	-1.35
	(0.91)	(0.73)	(-1.45)	(-0.7)	(-1.74)	(-1.6)	(-1.11)	(-1.7)	(-3.48)	(-0.58)	(-0.98)	(-1.04)	(-0.96)
Lack-of-Transp.		0.26**	-0.13	-0.24	0	-0.11	0.09	-0.32	0.4	0.59	0.46	-0.27	-0.65
		(2.37)	(-0.76)	(-1)	(0)	(-0.27)	(0.19)	(-0.74)	(0.86)	(1.3)	(1.09)	(-0.56)	(-1.06)
Political Conflict^2					4.32	4.51	3.04	2.76	7.65**	1.53	1.98	3.39	2.2
					(1.43)	(1.51)	(0.89)	(0.96)	(2.41)	(0.36)	(0.62)	(0.95)	(0.68)
Lack-of-Transp.^{2}					-0.16	-0.14	-0.53	-0.18	-1.07**	-0.98**	-0.87**	-0.09	0.2
					(-0.34)	(-0.33)	(-1.22)	(-0.47)	(-2.09)	(-2.17)	(-2.25)	(-0.22)	(0.26)
Credit				0.35***		0.32***	0.31***	0.31***	0.61***	0.42***	0.31***	0.31***	0.3***
				(3.55)		(3.34)	(3.19)	(4.16)	(5.45)	(4.23)	(3.18)	(2.97)	(3.1)
Energy				-0.17		-0.16	-0.07	-0.02	-0.28**	-0.12	-0.05	-0.1	-0.1
				(-1.14)		(-1.02)	(-0.52)	(-0.79)	(-2.35)	(-0.75)	(-0.36)	(-0.74)	(-0.72)
Business				0.24***		0.27***	0.21***	0.1	0.31***	0.34***	0.2***	0.22***	0.24***
				(3.37)		(4.23)	(2.96)	(1.56)	(4.99)	(4.23)	(2.82)	(3.16)	(3.55)
GDP per capita				-0.02		-0.01	-0.11**	-0.19***	-0.08*	-0.11*	-0.11**	-0.1*	-0.1*
				(-0.34)		(-0.25)	(-2.12)	(-4.22)	(-1.71)	(-1.94)	(-2.42)	(-1.85)	(-1.83)
GDP growth				0.06		0.18	-0.34	-5.4**	-0.29	-0.01	-0.31	-0.28	-0.19
				(0.11)		(0.32)	(-0.59)	(-2.48)	(-0.64)	(-0.01)	(-0.55)	(-0.49)	(-0.32)
Majoritanian				0.04		0.06	0.04	0.04	-0.09	0.01	0.03	0.05	0.05
				(0.65)		(1.02)	(0.68)	(0.65)	(-1.04)	(0.11)	(0.5)	(0.7)	(0.76)
Openess				0		0	0*	0***	0	0	0**	0	0
				(1.42)		(1.39)	(1.77)	(2.83)	(1.64)	(0.98)	(2.19)	(1.37)	(1.26)
Pop>65				1.16		1.45	1.56	1.45	0.46	2.26	1.8	1.19	0.9
				(1.01)		(1.23)	(0.95)	(1.06)	(0.47)	(1.26)	(1.06)	(0.77)	(0.59)
Continent dummies	0	0	0	0	0	0	1	1	0	1	1	1	1
Expl. Average	0	0	0	0	0	0	0	1	0	0	0	0	0
Only developing	0	0	0	0	0	0	0	0	1	0	0	0	0
Short Sample Debt	0	0	0	0	0	0	0	0	0	1	0	0	0
Transparency alt.	0	0	0	0	0	0	0	0	0	0	1	2	3
N	66	66	66	66	66	66	66	66	47	66	66	66	66
R^2	0.02	0.09	0.16	0.37	0.19	0.4	0.48	0.58	0.63	0.56	0.48	0.48	0.47
$\bar{R}^2$	0	0.06	0.12	0.24	0.12	0.25	0.29	0.42	0.49	0.39	0.29	0.29	0.26
Durbin Watson	1.57	1.67	1.71	1.97	1.67	1.98	2.11	1.96	2.3	2.06	2.21	2.03	2.06

Note: In this table we report the estimates of the regression in (1). The dependent variables is the debt-to-GDP ratio (external and internal) for each of the 66 countries reported in Appendix B for the period 1981 to 2010. Different specification accounts for several controls. T-statistics are reported in parenthesis. (*) indicates significance at 10 percent; (**) indicates significance at 5 percent; (***) indicates significance at 1 percent. Standard errors are calculated using heteroskedasticity consistency estimator White (1980).

3 The Model

In this section we describe our economy of interest. Two are the most important features of the model. First, we consider *political conflict*: as in Alesina and Tabellini (1990a), the economy is populated by several groups of domestic agents that are represented by political parties. The incentive of an incumbent to favour her group constitutes a political conflict. Second, in our more general framework we introduce the concept of *transparency*. We assume that lack of transparency induces inability of voters to judge and assess politicians. Therefore, a non-transparent environment leads voters to base their support to an incumbent only when her mandate was characterized by good economic performance, which in our model means higher aggregate consumption level and utility. In this sense, we generalize Amador and Aguiar (2011) by assuming that the probability of reelection is constant only in an economy characterized by transparency, and that it is instead a function of previous aggregate consumption levels in an economy where transparency is absent. We will show that these two features jointly are able to replicate the empirical facts displayed in the previous section.

3.1 Preferences

Consider a neoclassical small open economy model with $N+1$ equally sized groups of domestic agents, each represented by a political party. Each period one of the $N+1$ parties is in office and the incumbent party remains in power with a given probability $p(\cdot)$. Conditional on the incumbent losing the elections, each opponent party has equal probability $\frac{1-p(\cdot)}{N}$ of being elected. In a non-transparent economy the probability of being reelected is a positive function of aggregate consumption, whereas in a transparent economy, that probability is constant and fixed, as in Amador and Aguiar (2011). We model political conflict by using the partisan approach; the party in power decides borrowing and consumption allocation to the different groups. We define the utility at time t of party i when that same party i is in power as:

$$\mathcal{U}^{i,i}(c_t^i) = \theta_{i,i} u(c_t^{i,i}) + \sum_{q \neq i} \theta_{i,q} u(c_t^{i,q}), \tag{2}$$

where $\theta_{i,j} \geq 0$, $\forall i,j$ s.t $\sum_{j=1}^{N+1} \theta_{i,j} = 1$, is the weight that party i associates to the utility of party j, and $c_t^i = \left\{c_t^{i,1}, \ldots, c_t^{i,N+1}\right\}$ is the consumption allocation decided by party i. A political party i cares about all the agents in the economy, but gives higher weight to agents of its group i, meaning that $\theta_{i,i} \geq \theta_{i,j}$. The instantaneous utility function $u(\cdot)$ satisfies the standard conditions, that is $u(\cdot)$ is uniformly continuous, twice continuously differentiable, strictly increasing in c, and satisfies the Inada conditions. Instead, the utility of an opposition

party r when party i is in power, is defined as:

$$\mathcal{U}^{i,r}(c_t^i) = \theta_{r,r} u(c_t^{i,r}) + \sum_{q \neq r} \theta_{r,q} u(c_t^{i,q}).$$

Moreover, we assume no discrimination, i.e. each party weights equally the utility of other types of agents and likes to be in power as the other parties do. In this way we have simplified the problem by imposing symmetry, meaning that we are also going to restrict our attention to equilibria that are symmetric. The symmetry assumption imposes that $\theta_{i,i} = \theta \, \forall i$ and $\theta_{i,q} = \frac{1-\theta}{N} \forall i, q$ such that $\frac{1}{N} \leq \theta < 1$; hence, we can simply ignore the identity of the party in power and at the opposition. Therefore, for the rest of the paper and for simplicity we denote the utility of the incumbent i as $U^I(c_t) \equiv \mathcal{U}^{i,i}(c_t^i)$ and the utility of any opposition party, r, as $U^O(c_t) \equiv \mathcal{U}^{i,r}(c_t^i)$. We exclude the case with $\theta = 1$ in order to avoid corner solutions.[9] Each party is born at 0 and lives for T periods and discounts future utility at rate β.

3.2 International Financial Market and Output

The party in power (incumbent) has the ability to borrow or lend using an internationally traded one-period risk-free non-contingent real bond. Borrowing and saving allow the government to diverge the amount of aggregate consumption from the exogenous aggregate income and to distribute it intertemporally. Similarly to a small-open economy setting, the evolution of the debt position of the government is:

$$d_{t+1} - d_t = r_t d_t + c_t - y_t, \tag{3}$$

where d_{t+1} denotes the debt position at the beginning of period $t+1$, chosen in period t, r_t denotes the country interest rate, and y_t is an exogenous stochastic endowment. We assume that each party cannot renege the debt contract in each period even if it was stipulated by another party.[10] We implicitly assume that the country is a small-open economy, which we believe is a reasonable assumption given the set of countries considered in the empirical section; the domestic interest rate is assumed to be the sum of the world interest rate $r^* > 0$, assumed to be constant, and a country-premium that is increasing in a detrended measure of

[9] See Alesina and Tabellini (1990b) for a model where each party cares only about her personal consumption, in such a case the borrowing implications are very different

[10] See Cuadra and Sapriza (2008) and Prosperi (2016) for a discussion of the case when the government can actually default.

aggregate debt, as in Garcia-Cicco et al. (2010), i.e.:

$$r_t = r^* + \psi \left(e^{\tilde{d}_{t+1} - \bar{d}} - 1 \right).$$

The variable $\tilde{d}_t$ denotes the aggregate level of external debt, which is taken as given, ψ measures the sensitivity of the country-specific interest rate to its debt position, and $\bar{d}$ is a reference point. In equilibrium $\tilde{d}_t = d_t$. Also, since the economy ends at T it must be that $d_{T+1} = 0$.

Output is assumed to follow a first-order autoregressive process, i.e.

$$\log(y_t) = \rho_y \log(y_{t-1}) + \sigma_y \epsilon_t,$$

where $\epsilon_t \sim N(0, 1)$. In each period, the party in power (incumbent) decides the amount of borrowing (lending) in the one-period bond (d_{t+1}) and the allocations of consumptions across the different type of agents, such that $\sum_{i=1}^{N+1} c_t^i = c_t$.

3.3 Political Economy

We consider a political environment where political power fluctuates between the $N + 1$ parties (players). Hence, we introduce political uncertainty in the model as an additional stochastic process. Also, as in Acemoglu et al. (2011), the incumbent decides consumption allocation between groups, but in our case the incumbent decides the amount of debt next period.[11] As in Acemoglu et al. (2011) the timing is as follows:

1. In each period t, we start with one party, i, in power.

2. Exogenous output y_t realizes.

3. Party i chooses the level of aggregate consumption c_t by choosing the quantity of debt to carry to the next period, d_{t+1}.

4. Given the level of aggregate consumption c_t, party i chooses consumption allocations for each type of agents, c_t^i, subject to the feasibility constraint $\sum_{j=1}^{N+1} c_t^j = c_t$.

5. Political uncertainty resolves. In an economy with transparency, the re-election probability parameter p, which determines the likelihood that an incumbent will be in power also in the next period, is constant. Instead, with lack of transparency p follows a first order Markov process. In this case, then, the probability of party j to retain office in

[11] Acemoglu et al. (2011) considers a closed economy with zero external borrowing.

$t+1$ depends on the level of aggregate consumption c_t, and it is equal to $p(c_t)$, where $p(\cdot)$ is a continuously differentiable and increasing function. If the incumbent j is not reappointed (event with probability $1-p(c_t)$), then the opposition parties have equal probability of being in power. Hence, each opposition party will be in office in period $t+1$ with probability $\frac{1-p(c_t)}{N}$.

In Appendix C we describe in detail the Symmetric Markov Perfect Equilibrium that arises from this political environment.

Remark. In the rest of the paper we assume that the function $p(c)$ is given and exogenous. This approach allows us to clearly analyze the difference between the standard case in which the reelection probability is constant to the one in which it depends on economic conditions. Although certainly interesting, micro-funding that function is outside the scopes of this paper, which, in contrast, focuses on the effects of that function, more than on its genesis.

In our framework the political setup induces two kinds of frictions:

1. The uncertainty from political elections together with the political conflict creating disagreement about redistribution (as in Alesina and Tabellini (1990a));

2. The strategic behaviour of the incumbent to increase her probability of re-election by increasing aggregate consumption via borrowing in a non-transparent economy. (see Rogoff (1990) and Rogoff and Sibert (1988))

In the next sections we show that, with commonly used utility function, political uncertainty [1] is not in general sufficient to create incentives for the incumbent to borrow. In contrast, the strategic behaviour induced by lack of transparency [2] is able generate significant amount of borrowing in the economy. This result implies that heterogeneity in the degree of transparency and political conflict can produce large heterogeneity in borrowing decisions that is observable in the data.

3.4 The Benchmark: Transparent Economy with No Political Conflict

In order to study the role of political conflict and lack of transparency in consumption-saving decisions, we use the following strategy. First, we shut down both channels to consider a benchmark model without frictions. Then, we add first political conflicts alone, and we compare the resulting borrowing incentives with the frictionless model. Finally, we include also lack of transparency and we investigate how borrowing incentives are driven by the

interaction of these two frictions. To obtain useful analytical results, we first simplify the model assuming that the economy lasts only two periods, $t = 1, 2$, and that output, y, and the interest rate, r, are constant. Since the economy lasts only two periods, no borrowing is allowed in the last period and it will be not optimal to save in the last period; hence $d_3 = 0$. We also assume that the discount factor is $\beta^{-1} = 1 + r$, so that there is no other borrowing or lending incentive in the model other than the one resulting from political frictions.

As a benchmark for comparison we consider the model where all frictions are eliminated, which happens when a party weights equally the instantaneous utility of each group, i.e. when $\theta_{q,i} = \frac{1}{N+1}$ $\forall q, i \in 1, ..., N+1$. In this case each party is indifferent to be in power or in opposition as that would imply an identical consumption distribution; hence, we have that: $U^I(c_t) = U^O(c_t) = u\left(\frac{c_t}{N+1}\right)$. As evident, in this case the political economy component of the model is shut down, since any incumbent will equally distribute aggregate consumption across agents, and, as a result, the political uncertainty does not play any role.

In the two period economy, the game is extremely simplified. Since at period 2 the total amount of debt must be fully repaid, the action of the incumbent in period 2 is completely determined in a symmetric equilibrium case. Since there is no disagreement there is no reason to deviate from the optimal equal sharing rule. Hence, the solution of the borrowing problem is determined by maximing the intertemporal utility as:

$$\begin{aligned} &\max_{\{c_1, c_2, d_2\}} u\left(\frac{c_1}{N+1}\right) + \beta u\left(\frac{c_2}{N+1}\right) \\ \text{s.t. } &d_{t+1} = (1+r)\, d_t + c_t - y, \text{ for } t = 1, 2 \\ &d_3 = 0, \end{aligned}$$

with d_1 given. The equilibrium of the frictionless model is given by:

$$u'\left(\frac{y + d_2 - (1+r)\, d_1}{N+1}\right) = u'\left(\frac{y - (1+r)\, d_2}{N+1}\right). \tag{4}$$

This condition implicitly characterizes the optimal debt in the frictionless economy, which we denote as d_2^*, as a function of the parameters d_1, r, N, y. Importantly, note that in this benchmark economy, the optimal level of debt d_2^* is such that consumption is equalized in the two periods, i.e. $c_1 = c_2$.

3.5 The Transparent Economy With Political Conflict

Let us now consider the economy with political conflicts, in which the incumbent i values the utility of his party $\theta_{i,i} = \theta > \frac{1}{N+1}$. We still consider a transparent economy by assuming that the probability of an incumbent to be reelected is a constant and equal to p.

Given a level of aggregate consumption, the incumbent's utility is:

$$U^I(c) = \theta u\left(c^I\right) + (1-\theta)\, u\left(\frac{c-c^I}{N}\right), \tag{5}$$

where c^I is the value of consumption held by the incumbent party. Similarly, each opposition party's utility is:

$$U^O(c) = \frac{(1-\theta)}{N} u\left(c^I\right) + \left(1 - \frac{(1-\theta)}{N}\right) u\left(\frac{c-c^I}{N}\right),$$

since the opposition values θ his own instantaneous utility and $\frac{(1-\theta)}{N}$ the utility of the incumbent and of the other N opposition parties. When there are political conflict, for a given level of aggregate consumption, c, the incumbent follows the optimal sharing rule that is given by maximizing the incumbent's utility in equation (5), which gives:

$$\theta u'\left(c^I\right) = \frac{(1-\theta)}{N} u'\left(\frac{c-c^I}{N}\right). \tag{6}$$

Therefore, in case of political conflicts, the incumbent maximizes the intertemporal utility with respect to $\{c_1, c_2, d_2\}$, anticipating that the incumbent at period 2 will repay the public debt, and implementing the optimal sharing rule.[12] Hence, the problem for the incumbent is then:

$$\begin{aligned}
&\max_{\{c_1,c_2,d_2\}} U^I(c_1) + \beta\left[pU^I(c_2) + (1-p)\, U^O(c_2)\right] \\
\text{s.t. } & d_{t+1} = (1+r)\, d_t + c_t - y, \text{ for } t = 1,2 \\
& d_3 = 0, \\
& \theta u'\left(c_t^I\right) = \frac{(1-\theta)}{N} u'\left(\frac{c_t - c_t^I}{N}\right), \text{for } t = 1,2.
\end{aligned}$$

[12] Suppose, instead, that the incumbent does not apply the optimal sharing rule. Then, the incumbent at period 2 could threaten the incumbent at period 1 by applying a more severe sharing to induce him not to overborrow. Such an equilibrium would not be sub-game perfect, since in the stage game the incumbent will never implement a different sharing rule. This kind of reasoning always applies with finite games.

The equilibrium condition of this problem is:

$$U^{I'}(y-(1+r)\,d_1+d_2)=\left[pU^{I'}(y-(1+r)d_2)+(1-p)\,U^{O'}(y-(1+r)d_2)\right], \tag{7}$$

where

$$U^{I'}(c) = \theta u'\left(c^I\right)\frac{\partial c^I}{\partial c}+\frac{(1-\theta)}{N}u'\left(c^O\right)\left(1-\frac{\partial c^I}{\partial c}\right), \tag{8}$$

$$U^{O'}(c) = \frac{(1-\theta)}{N}u'\left(c^O\right)\frac{\partial c^I}{\partial c}+\frac{1}{N}\left(1-\frac{(1-\theta)}{N}\right)u'\left(c^O\right)\left(1-\frac{\partial c^O}{\partial c}\right), \tag{9}$$

where $c^O=\frac{c-c^I}{N}$ is the amount of consumption of each opposition party. The equilibrium condition (7) defines the equilibrium level of debt in case of political conflict, $\tilde{d}_2^*$. Political conflicts affect the intertemporal decision of the incumbent. When the incumbent is deciding the optimal level of debt, she takes into account that the marginal cost of an extra unit of debt in period-1 is the weighted average of the period-2 marginal utility of being incumbent and opponent. Depending on the relative size of these two marginal utilities, political conflicts can generate more saving or more borrowing with respect to the frictionless case. Proposition (1) states the conditions for having more saving in a partisan economy with respect to the frictionless economy.

Proposition 1. ***Political Conflicts and Savings.*** *Consider the political economy model as specified above; then the following statements are equivalent:*

(a) $\tilde{d}_2^* \leq d_2^*$, *i.e. political conflicts generate saving incentives*

(b) $U^{I'}(c) \leq U^{O'}(c)$

(c) $\theta \geq \frac{\partial c^I}{\partial c}$

(d) $\frac{u''(c^O)}{u''(c^I)} \leq \left(\frac{u'(c^O)}{u'(c^I)}\right)^2$

See Appendix D.1 for the proof. This result is in contrast with Amador and Aguiar (2011) that showed that political frictions generate incentive for borrowing. The reason for their result is that they modelled political frictions using the opportunistic approach were the incumbent has *per se* larger marginal utility than the opponent. In our setting that is not generally the case. In fact, Proposition 1 states that when the marginal utility of the incumbent is lower then the marginal utility of the opponent then political conflicts induce saving incentives. This is an intuitive result: if that condition is satisfied, a unit of consumption is more valuable for the opposition than for the incumbent. Hence, a party is

willing to move resources from the incumbent state to the opposition state. Given that in time $t = 1$ the decision maker is the incumbent and that there is some positive probability that at time $t = 2$ that agent will be at the opposition, she is then willing to move resources intertemporallty from $t = 1$ to $t = 2$. Notice that, as equations (8) and (9) show, the marginal utilities of the incumbent and opposition depend on the property of the utility function not only through its first derivative u', but also from its second derivative through the sharing rule $\frac{\partial c^i}{\partial c}$. In fact, by using the implicit function theorem on equation (6), it is trivial to show that:

$$\frac{\partial c^I}{\partial c} = \frac{\frac{1-\theta}{N^2} u''\left(\frac{c-c^I}{N}\right)}{\theta u''(c^I) + \frac{1-\theta}{N^2} u''\left(\frac{c-c^I}{N}\right)}. \tag{10}$$

The shape of the utility function is then a crucial determinant on the role of political frictions. We now define a general class of utility functions that have the useful property of implying a proportional optimal sharing rule

Definition 1. Proportional Sharing Rule. An utility function satisfies the Proportional Sharing Rule (henceforth, PSR) property if the derivative $\frac{\partial c^I}{\partial c}$ solution of the optimal sharing rule in equation (6) is constant, i.e. if:

$$\frac{\partial c^I}{\partial c} = \psi, \quad \forall \psi \in \Re.$$

The following corollary defines the condition for a utility function to satisfy the PSR.

Corollary 2. *Consider an utility function $u(c)$ and denote the inverse of its marginal utility as $g(\bar{u}) = u'^{-1}(\bar{u})$. Rewrite the argument $\bar{u}$ as the product of two real numbers, a and x. If the function $g(\cdot)$ satisfies the following property:*

$$g(\bar{u}) = g(ax) = h(a)g(x) + l(a), \tag{11}$$

then the utility function $u(c)$ also satisfies the PSR property. Here, $h(\cdot)$ and $l(\cdot)$ are real-valued functions.

See Appendix D.2 for the proof.

Condition (11) is quite general. In fact, it is satisfied for any utility function that belongs to the hyperbolic absolute risk aversion (HARA) utilities, as proved in the following Corollary.

Corollary 3. ***HARA utility function and PSR.*** *An utility function that belongs to the*

class of Hyperbolic Absolute Risk Aversion (HARA) utility functions, i.e. such that:

$$u(c) = \frac{\sigma}{1-\sigma}\left(\frac{ac}{\sigma} + b\right)^{1-\sigma}$$

with $a > 0$ *and* $\frac{ac}{\sigma} + b > 0$*, satisfies the PSR property.*

See Appendix D.3 for the proof. As a consequence, the most common utility functions (CRRA, logarithm, linear, quadratic, exponential) satisfy the PSR property.

An interesting consequence of proposition 1 arises when considering the CRRA utility function.

Corollary 4. ***CRRA and Savings****. Consider the political economy model as specified above: if* $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$*, then:*

(a) $\frac{\partial c^I}{\partial c} = \psi = \frac{\left(\frac{\theta}{1-\theta}\right)^{\frac{1}{\sigma}} N^{\frac{1-\sigma}{\sigma}}}{1+\left(\frac{\theta}{1-\theta}\right)^{\frac{1}{\sigma}} N^{\frac{1-\sigma}{\sigma}}}$.

(b) $\theta \geq \psi \iff \sigma \geq 1$.

(c) $\tilde{d}_2^* \leq d_2^* \iff \sigma \geq 1$*, with* $\tilde{d}_2^* = d_2^* \iff \sigma = 1$.

See Appendix D.4 for the proof. In the case of the CRRA utility function the saving condition is always satisfied whenever $\sigma \geq 1$. When $\sigma \to 1$ (log utility case) the marginal utility of the incumbent is equal to the marginal utility of the opposition party, and by Proposition 1 the equilibrium under political uncertainty is identical to the one in the frictionless economy, for any value of p or θ. Hence, when considering logarithm instantaneous utility, political uncertainty does not affect the consumption-saving decision.

As pointed out, the incentive for an incumbent to save relies on the willingness to bring resources from its incumbent state to a possible opposition states. When the latter is less likely, the saving incentive is reduced. The next corollary formally states this feature.

Corollary 5. ***Political uncertainty and Savings****. Assuming that the utility function satisfies the PSR property and it is such that* $U^{I\prime}(c) \leq U^{O\prime}(c)$ *and, then* $\frac{\partial \tilde{d}_2^*}{\partial p} > 0$ *and* $\lim_{p \to 1} \tilde{d}_2^* = d_2^*$.

See Appendix D.5 for the proof. The 2-period case that we have discussed in this section, had been already studied in Alesina and Tabellini (1990b). The authors studied the case with $\frac{1}{2} < \theta < 1$ and derived the same condition for borrowing that is presented in proposition 1 in terms of ratios of the *concavity index* defined by Debreu and Koopmans (1982). As it is stated in our Proposition 4 they argue that for the CRRA case, the borrowing condition

is satisfied whenever $0 < \sigma < 1$. The problem is that this assumption makes it difficult to reconcile model predictions with data. Indeed for the CRRA case, it is easy to show that the decision maker in the economy (i.e. the incumbent) has marginal utility:

$$U^{I'}(c) = \kappa(\sigma, \theta, N)c^{-\sigma}$$

From the Euler Equation it can be shown that the responsiveness of consumption growth to a variation of the interest rate is completely determined by $1/\sigma$ as in standard intertemporal model with CRRA utility functions. This means that with $\sigma < 1$ consumption growth is highly responsive to interest rate, an implication that the literature has largely showed that is irreconcilable in the data.[13] Since our final goal is to use a model that has realistic implications in the quantitative analysis, in what follows we assume that $\sigma \geq 1$. In this case, then, without any other friction, political uncertainty and political conflict do not generate borrowing incentives. Finally, the last implication of Corollary 5 states that when political uncertainty disappears, i.e. $p = 1$, the precautionary saving motives for an incumbent disappears, since it will certainly stay in power forever. In this case, political conflict does not alter the optimal decision of debt with respect to the benchmark frictionless economy.

3.6 The Non-Transparent Economy With Political Conflict

In the previous section we have pointed out that, under the commonly used parameterization of utility functions, political uncertainty alone does not generate borrowing incentives. In this section we now introduce an important feature of our model, i.e. the lack of transparency, which we assume induces retrospective voting. We show that this feature is able to provide borrowing incentives and, most importantly, it interacts with political conflicts in the similar way as empirically estimated in Section 2. In what follows we modify the model presented above by assuming that the probability of being reelected is an increasing function of the aggregate consumption, $p(c)$. In what follows we assume that that the instantaneous utility function $u(\cdot)$ satisfies the PSR property, i.e. $\frac{\partial c^I}{\partial c} = \psi$. The problem for the incumbent is, then :

[13] Furthermore, in macro finance literature it is clear that $\sigma < 1$ does not provide any good result in explaining how agents face risky decisions.

$$\max_{\{c_1,c_2,d_1\}} U^I(c_1) + \beta\left[p\left(c_1\right)U^I(c_2) + \left(1-p\left(c_1\right)\right)U^O(c_2)\right] \tag{12}$$

$$\text{s.t. } d_{t+1} = (1+r)\,d_t + c_t - y, \tag{13}$$

$$\text{and } \theta u'\left(c_t^I\right) = \frac{(1-\theta)}{N}u'\left(\frac{c_t - c_t^I}{N}\right) \ \forall t = 1,2, \tag{14}$$

$$d_3 = 0. \tag{15}$$

The first order condition of this problem reads:

$$\left\{\begin{array}{c} U^{I'}(c_1)+ \\ +\beta p'\left(c_1\right)\left[U^I(c_2) - U^O(c_2)\right] \end{array}\right\} = \left\{\begin{array}{c} p\left(c_1\right)U^{I'}(c_2)+ \\ \left(1-p\left(c_1\right)\right)U^{O'}(c_2) \end{array}\right\}. \tag{16}$$

The solution of this equilibrium condition delivers the optimal level of debt in a non-transparent economy, $\hat{d}_2^*$.

Comparing the equilibrium condition above with the equilibrium condition of the economy with constant probability of re-election (equation (7)), lack of transparency adds an additional term to the marginal benefit of borrowing, since increasing debt, and therefore aggregate consumption, now increases the probability of being re-elected by $p'(c)$. A higher probability of being re-elected has a value equal to the difference in utility between the incumbent state and the opposition state at period 2. Since this difference is always positive, and since $p^{'}(c) > 0$, this additional term increases the marginal utility of borrowing. Notice that the first order condition in (16) could not be a sufficient condition for the equilibrium. In Appendix D.6, Lemma 7, we display the sufficient condition on $p(c)$ to guarantee that the equilibrium condition (16) characterizes a global maximum.

Under those conditions, we can prove the following proposition.

Proposition 6. ***Lack of Transparency and Borrowing****. Assume conditions (26)-(27) are satisfied. Define as $\hat{d}_2^*$ the solution of the the two period model with lack of transparency that solves equation (16); define as $\tilde{d}_2^*$ the solution of the model with transparency that solves (7); define as d_2^* the solution of the frictionless benchmark model that solves equation (4), then:*

1. *Given a degree of political conflict $\theta > \frac{1}{N+1}$, a non-transparent economy has higher borrowing incentives than a transparent economy, i.e. $\tilde{d}_2^* < \hat{d}_2^*$;*

2. *If $p'(c)$ is large enough, than a non-transparent economy with political conflict has higher borrowing incentives than the benchmark frictionless economy, i.e. $d_2^* < \hat{d}_2^*$*

See Appendix D.7 for the proof. Proposition 6 is a crucial result to link political friction to borrowing incentives. In fact, when local maxima of problem (12)-(15) are ruled out, we can formally prove that lack of transparency reduces saving incentives generated by political uncertainty and can create borrowing incentive if the sensitivity of the probability of being reelected is sensitive enough to aggregate consumption.

In Appendix D.8 we investigate analytically these questions for log utility function and linear probability, i.e. when $p(c) = \gamma + \alpha(c - \bar{c})$. Notice that here the parameter α incorporate the degree of lack of transparency: if $\alpha = 0$, then the reelection probability is constant and equal to γ; instead, the larger α, the strongest the reelection probability is linked to economic performances. Although potentially this function could obtain values outside the $[0, 1]$ interval, in the following exercise we make sure that the realizations of the election probability lie in that interval.

In this specific case we can easily check that: (i) borrowing solutions always exist; (ii) we can always characterize a threshold level for $\tilde{\alpha}$ s.t. if $\alpha > \tilde{\alpha}$ we have positive level of debt; (iii) $\tilde{\alpha}$ is independent of θ; (iv) when utility is logarithmic then $\partial d_2/\partial\theta > 0$ when $\alpha > \tilde{\alpha} = 0$.

3.7 Debt Incentives in a T-period model

Here we generalize the model by considering an economy with T large. This generalization is important since one of our goal is to study the impact of political frictions on the level of debt of the economy. Since an analytic solution is not available when allowing for an arbitrarily large number of periods, we solve the problem of the incumbent by backward induction by assuming that each party plays Symmetric Markov Strategy. In this section we assume that the election probability is linear, i.e.

$$p(c) = \gamma + \alpha(c - \bar{c}). \tag{17}$$

In Appendix E we show the robustness of our results when assuming a non-linear utility function that is always bounded in the interval $[0, 1]$. To show that the analytical results we have derived for a 2-period model hold even in a large-T economy, we numerically solve the model and compute the average level of debt as a function of the two main parameters of interest: the degree of political friction, θ, and the degree of transparency, α. For illustrative purpose, in this exercise we shut down fluctuations in output, so that political shocks are the only source of uncertainty. The rest of the parameters are calibrated as discussed in Section 4.1.

Table 4 shows how the average equilibrium level of debt (measured in percentage of the

Table 3 – Equilibrium Level of Debt in a T-period model

	α				
	0	0.5	1	1.5	2
θ=0.5	0	0	0	0	0
θ=0.6	-3.6	-0.4	0	0.2	2.0
θ=0.7	-12.4	-2.9	0.2	10.3	14.0
θ=0.8	-25.6	-8.0	2.7	39.9	63.8
θ=0.9	-35.7	-14.3	7.7	58.1	110.5

Note: In this table we report the average level of debt (in percentage) in a T-period economy, with $T = 2250$, when assuming CRRA utility function and linear probability, for different values of degree of lack of transparency (α, x-axis) and degree of political friction, θ. Negative values denote savings.

GDP) varies with the degree of political friction, θ, and the degree of lack of transparency, α, when considering an economy that lasts for $T = 2250$ periods. Several results are worth noting. First notice that, not surprisingly, when political frictions are absent (i.e. $\theta = 0.5$, since we assume that there are only two parties, $N = 1$) the economy experiences no borrowing or saving, since in this case there is no incentive for the incumbent to distort voting; in other words the only uncertainty in the economy, which is political uncertainty, is irrelevant and, as a consequence, there are no incentive to save or borrow. In contrast, when political frictions arise (i.e. $\theta > 0.5$) Table 4 highlights two important features of the model.

1. Consistently with the analytical results derived for the two period model, for a given level of θ, the economy on average accumulates savings when voters live in a transparent economy, i.e. for low values of α, and the economy in average accumulate debt when lack of transparency arises (i.e. for large values of α).

2. Consistently with the analytical results derived for the two period model, the effect described above are more pronounced when political conflicts are stronger. In fact, when θ increases, precautionary saving are even larger in a transparent economy, and borrowing incentives are stronger in a non-transparent economy.

These results show the consistency of the results for the T periods economy with the findings derived analytically when studying the two-periods model. Hence, we infer that most of our conclusions should hold also in general for more complex macroeconomic models. In particular, political frictions together with a different intensity of lack of transparency are able to generate cross-country heterogeneity in debt dynamics and strong political conflicts can generate at the same time political instability and large levels of sovereign debts if voters

are sufficiently sensitive to economic conditions. At the same time, whenever voters are not influenced by economic performances, political conflicts and political uncertainty generate savings.

4 Bringing the Model to the Data

The theoretical model that we have proposed is able to generate heterogeneity of level of debts across economies by varying the degree of political conflicts and transparency. In this section we investigate whether these two ingredients alone are able to capture the different level of debts across countries as well as other important political economy and macroeconomics features. Specifically, our strategy is as follows. First, we select observable moments in the model that have a clear counterpart in the data. We will show how, theoretically, these moments are largely affected by the degree of transparency, α, and political conflicts θ. Then, for each country we use the prediction of our model to estimate these two parameters. We then show that these two channels are able to replicate the observed heterogeneity in debt levels and other macroeconomic fundamentals, and, importantly, that the estimated degree of transparency and political conflict are indeed highly correlated with their proxies we have used in the empirical section. We consider the same economies considered in the empirical section and listed in Appendix B. Economic data and institutional variables used in this section are described in Appendix A.

4.1 Strategy and Calibration

First, we calibrate some parameters that remain constant across the different economies. Our goal is to investigate whether heterogeneity in transparency and political frictions alone can explain the heterogeneity in debt levels and other macroeconomic variables. Hence, we shut down possible heterogeneity in preference and on financial markets, but we allow for heterogeneity in the output process. We fixed the word interest rate $r^* = 0.07$, which correspond at an annual rate of 7 percent, as reported in Uribe and Yue (2006). The subjective discount rate is then pinned down such that $\beta = (1+r^*)^{-1} = 0.9346$. The coefficient of relative risk aversion, σ, is assumed to be 2. The debt elasticity of the interest rate, ψ is fixed at 0.1. The reference level of debt in the interest rate equation is assumed to be zero, which is $\bar{d} = 0$. We consider a linear probability function as in equation (17), i.e. $p(c) = \gamma + \alpha(c - \bar{c})$, and we fixed the reference parameter $\bar{c}$ to be equal to 1; this value is identical to the unconditional mean of the exogenous endowment, in level, received by the agents in each period. Hence, if

consumption in a given period is greater than the unconditional mean, the electorate is more likely to vote for the incumbent in a non-transparent economy ($\alpha > 0$).

The remaining parameters are assumed to be country-specific. The parameters that define the stochastic process for output are directly estimated from output data, by fitting an $AR(1)$ process on the deviation of the logarithm of GDP from its cubic trend, as in Garcia-Cicco et al. (2010). Hence, the deviation from the trend, in log, for country i follows: $y_t^i = \rho_i^y y_{t-1}^i + \sigma_i^y \epsilon_t^i$, where ϵ_t^i are iid, in the time dimension and cross-section dimension, disturbances. Hence, for each country, we will estimate directly from detrended GDP data the persistence of the income process, ρ_i^y, and the standard deviation of the error term, σ_i^y. Given that the utility function features risk aversion, different degrees of uncertainty in output realization imply different strength of precautionary saving motive.

Finally, there are three parameters to be estimated that are related to the two main channels introduced in our model; α_i, which measure the degree of retrospective voting, which we interpret as the degree of lack of transparency; γ_i, which is the probability of reelection of an incumbent in a transparent economy; and θ_i, which measures the degree of political conflict. We estimate these parameters by asking the model to replicate some features of the data, using a GMM-approach.

Specifically, for each country i, we estimated $\Theta_i = \{\alpha_i; \gamma_i; \theta_i\}$ as:

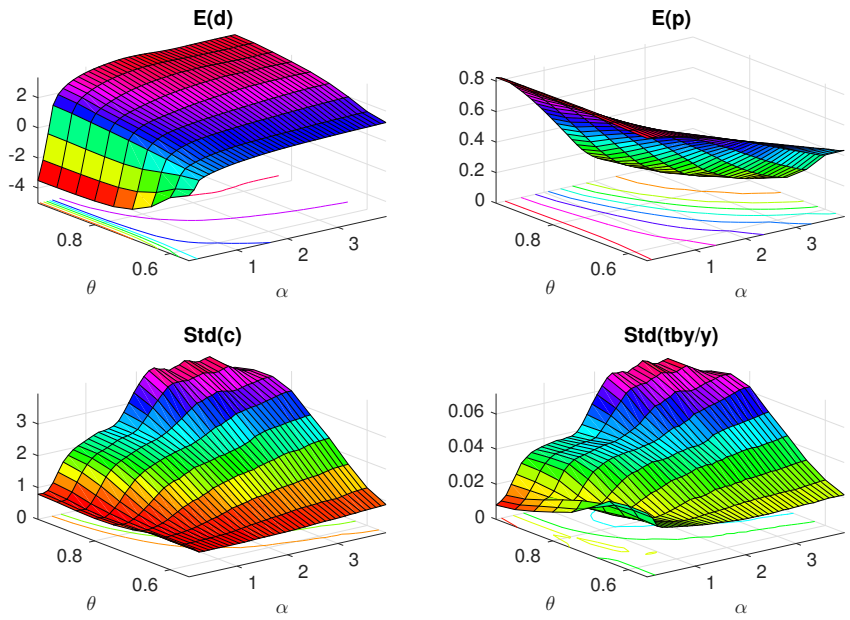
$$\Theta_i = \arg\min \left[E(Y_i) - E(Y(\Theta_i; \tilde{\Theta}_i))\right]' W_i \left[E(Y_i) - E(Y(\Theta_i; \tilde{\Theta}_i))\right], \tag{18}$$

where $E(Y_i)$ is a set of data moments, $E(Y(\Theta_i; \tilde{\Theta}_i))$ is their model counterpart, which are a function of the parameters to be estimated, Θ_i, and of the other calibrated parameters, gathered in the vector $\tilde{\Theta}_i = \left\{\rho_i^y, \sigma_i^y, \beta, \sigma, \bar{d}, r^*, \psi, \bar{c}, N\right\}$, and W_i is a weighting function. The weighting function is computed through a conventional two-step GMM procedure.

We include the following four moments, which are well defined in the model and that are directly observed in the data (see Appendix A for a complete description of the data source). The first moment is the average probability of reelection. This moment aims to make the model able to match the country-specific political turnover. The second moment is the average level of debt to gdp ratio, which aims to make the model to match the borrowing/saving outlook of a country. The third moment is the standard deviation of consumption, which is partly due to the variation in income that are taken into account by the calibrated parameters ρ_i^y and σ_i^y and to the country borrowing/saving dynamics. The fourth moment is the standard deviation of the trade-balance-to-output ratio, which is driven mainly by the borrowing/saving dynamics. To show that these four moments are able to identify the three parameters of

interest, in Figure 1 we simulate the model and display how these moments vary with α_i (x-axes) and θ_i (y-axes), for a given level of $\gamma_i = 0.75$, and assuming that $\rho^y = 0.75$ and $\sigma^y = 0.02$. We can observe that variations in the two parameters imply a large heterogeneity in the level of debt, as explained in the previous sections, in the reelection probability, and in the variance of consumption and trade-balance, which are not equivalent even qualitatively especially for low level of α_i. Also, our model predicts that high reelection probability can coexist with high levels of political conflict in very transparent economies; nevertheless, political instability emerges in non transparent economies: large debt accumulation reduces consumption in the long run and consequently reduces reelection probability. This result reconciles with the findings in Easterly and Levine (1997), which shows that the univariate relationship between political instability and ethnical conflict is rather ambiguous.

Figure 1 – Model Moments as function of Political Frictions and Transparency



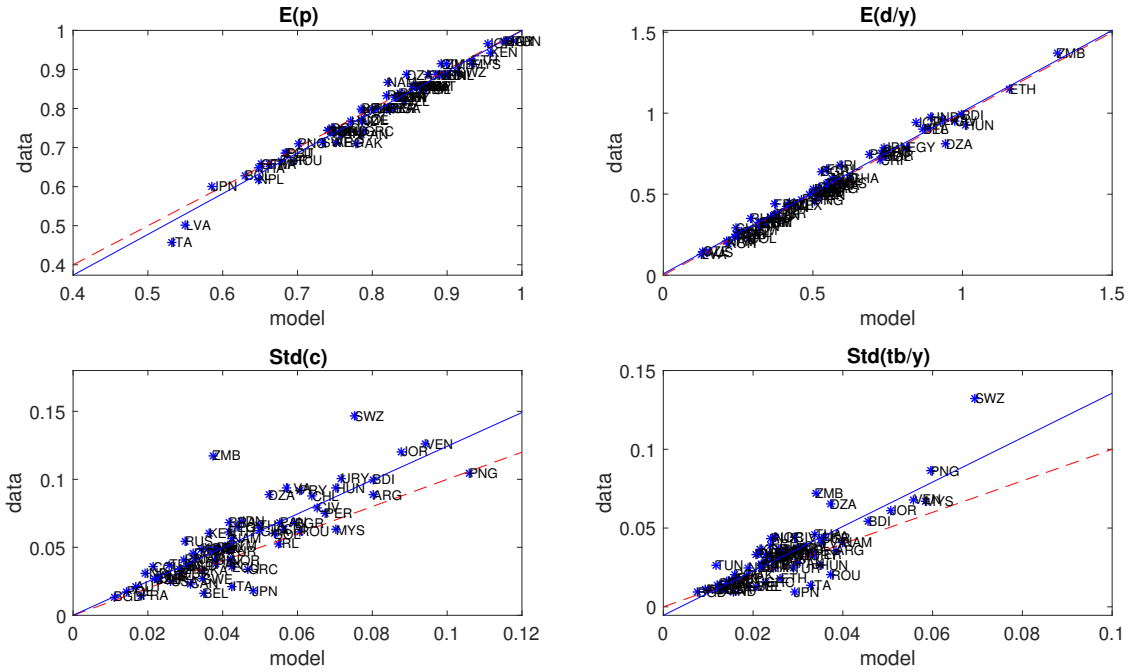
Note: In this Figure we plot the model-implied value of average debt (top-left panel), average reelection probability (top-right panel), standard deviation of consumption (bottom-left panel), and standard deviation of trade-to-output ratio (bottom-right panel), as a function of the degree of lack of transparency, α_i (x-axes), and political conflicts θ_i (y-axes). The other country specific parameters are fixed as follows: $\gamma_i = 0.75$, $\rho_i^y = 0.75$, and $\sigma_i^y = 0.02$. The moments are average of simulation with length $T = 2200$.

4.2 Fit

The first question to address is whether the three estimated parameters are able to provide a reasonable match for the four target moments. In Figure 2 we display the cross-sectional fit of the four moments. Specifically for each of the four moments (average mean reelection

probability, top-left panel; mean debt-to-gdp ratio, top-right panel; standard deviation of consumption, bottom-left panel; standard deviation of trade-balance to output ratio, bottom-right panel), we plot the data value for each country in the y-axis and its model counterpart computed at the estimated parameters value. If the model was able to perfectly match the data the scatter plots would lie in the 45 degree line (displayed with a continuous blue line). Since the fit is extremely good, we claim that variations in three parameters α_i, γ_i, and θ_i, together with the variations in the income process, are able to capture the cross-section heterogeneity in the four targeted models. Notice, that our estimation procedure attempts to match four moments with only three parameters.

Figure 2 – Fit



Note: This figure plots the model-implied moments of interest, i.e. average debt (top-left panel), average reelection probability (top-right panel), standard deviation of consumption (bottom-left panel), and standard deviation of trade-to-output ratio (bottom-right panel), at the estimated parameter values the x-axis, and their data counterpart in the y-axis, for each country in our sample. The blue solid line is the 45 degree line. The dashed red line is the regression line.

The same result can be derived by running a regression of the data moments of interest $E(Y_i)$ on their model counterpart evaluated at the estimated parameters:

$$E(Y_i) = b_0 + b_1 E(Y(\hat{\Theta}_i; \tilde{\Theta}_i) + \eta_i \tag{19}$$

Once again, if the fit were to be perfect, the regression coefficient of the slope would be equal to 1 and the coefficient of determination, R^2, would be 1. The fits is extremely good for

Table 4 – Fit

	Moment 1 Mean Reelection	Moment 2 Mean debt/GDP	Moment 3 Std Consumption	Moment 4 Std Tradebalance/GDP
Intercept: b_0	0.07	0.00	0.01	0.01
	(3.96)	(0.35)	(4.846)	(6.86)
Slope: a_1	0.92	0.98	0.55	0.508
	(43.02)	(52.88)	(11.98)	(12.88)
R^2	0.97	0.98	0.69	0.72

Note: In this table we report the cross-section regression parameters and the coefficient of determination, R^2, associated with the regression in equation (19). t-statistics associated to the coefficients are reported in parenthesis. The dependent variables are the four moments of interest as observed in the data. The independent variables is their model-implied counterpart, at the estimated parameter values.

the two first moments, while the fit of the two second moments is slightly less impressive, but still very satisfactory. Having a good fit in hand, we can now investigate whether the estimated parameters, $\hat{\alpha}_i$ and $\hat{\theta}_i$, that are able to match the targeted four moments are related to observed transparency and political conflict.

5 Validating the Model

Our empirical strategy estimates the degree of transparency, $\hat{\alpha}_i$, and of political conflicts, $\hat{\theta}_i$ for a country i, only by using data on macroeconomic moments. Hence, those estimates do not contain any information a priori on the observed degree of transparency and political conflict. In this section, we then investigate whether there is a link between the estimated parameters and the observed proxies for transparency and political conflict.

5.1 Hypothesis testing on the mechanism

The first step of our analysis is testing whether the main mechanism in our model, which is the interaction between lack of transparency and political conflict as a driver of debt incentives, is supported by the data. The GMM approach in equation (18) allows us to test the following joint hypothesis, for each country i, by computing the asymptotic distribution of the estimators:

$$\begin{aligned} H_0 &: \ \theta_i = \frac{1}{2}, \ \alpha_i = 0 \\ H_1 &: \ \theta_i > \frac{1}{2}, \ \alpha_i > 0 \end{aligned} \tag{20}$$

For all the country, the resulting F-statistic is very high and the test strongly rejects the null hypothesis.[14] Next, we investigate whether, for each country, $\theta_i = \frac{1}{2}$ and $\alpha_i = 0$, independently. These tests clarify whether the political conflict channel or the transparency channels are detected. In Table 5 we report the estimated parameters $\hat{\theta}_i$, $\hat{\alpha}_i$, and, for completeness, also $\hat{\gamma}_i$, and the associated standard error, in brackets.[15] For 44 out of 66 countries, we reject the null hypothesis of no political frictions, while for 42 countries we reject the null hypothesis of no lack of transparency. We conclude that: *(i)* no country exhibit absence of both frictions; and *(ii)* at least in two third of our sample a country displays either political conflict or lack of transparency.

5.2 Do the estimates capture transparency and political conflict?

We now investigate whether the estimated parameters $\hat{\theta}_i$ and $\hat{\alpha}_i$ do actually relate to the observed proxies of *political conflict* and *lack of transparency*, that we have defined and used in section 2 for the cross-country regressions.

Recall that the estimation procedure in equation (18) that we have implemented does not use any information regarding the degree of transparency and political conflict of a country, but it only employs the relationship between re-election probabilities, levels of debt, and consumption and trade balance variances. Therefore, if we find a positive relationship between the two estimates $\hat{\theta}_i$ and $\hat{\alpha}_i$ and the observed proxies of *political conflict* and *lack of transparency*, we can conclude that our simple model is able to attribute cross-country variations of debt to the interaction between transparency and political conflict.

A first natural step to explore whether the estimated parameters $\hat{\theta}_i$ and $\hat{\alpha}_i$ positive correlate with the observed proxies of *political conflict* and *lack of transparency*, is to draw a scatter plot of the model estimates and their proxies, for any given country. In Figure 3a and 3b we plot, on the x-axis, the empirical counterpart of θ and α defined in section 2, and on the y-axis we plot the estimated $\hat{\theta}_i$ and $\hat{\alpha}_i$. The correlations between model estimates and proxies are positive and equal to 0.26 and 0.27 for political conflicts and transparency, respectively.

Possibile explanation for imperfect fit Although the positive relationship between data and estimates is comforting, nevertheless it is not possible to ignore the evidence that there are disturbances around the linear relationship. The imperfect fitting may arise for two different reasons:

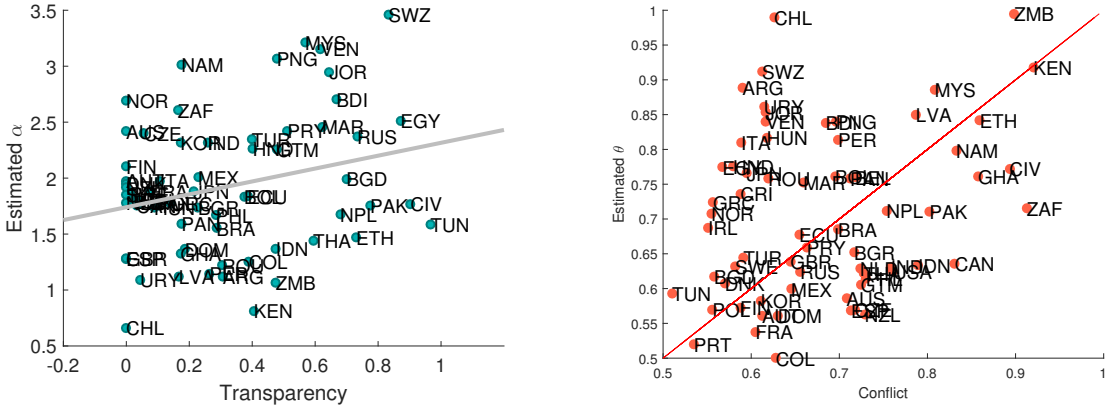
[14] Results of the F-statistic are available upon request from the author.
[15] For the intercept of $p(c)$ we tested the null hypothesis of $\gamma = 1$.

Table 5 – Estimated parameters

	$\hat{\theta}$	$\hat{\alpha}$	$\hat{\gamma}$		$\hat{\theta}$	$\hat{\alpha}$	$\hat{\gamma}$
ARG	0.89**	1.12***	0.89	KEN	0.92***	0.81***	1.07
	(0.17)	(0.38)	(0.09)		(0.06)	(0.12)	(0.05)
AUS	0.59***	2.42***	0.88**	KOR	0.58*	2.32***	0.8***
	(0.02)	(0.05)	(0.05)		(0.05)	(0.11)	(0.07)
AUT	0.56***	1.98***	0.85***	LVA	0.85***	1.12***	0.64***
	(0.02)	(0.13)	(0.02)		(0.03)	(0.14)	(0.11)
BGD	0.62***	1.99***	0.76***	MYS	0.89***	3.21***	1.68***
	(0.01)	(0.08)	(0.07)		(0.03)	(0.13)	(0.14)
BEL	0.76	1.79	0.92	MEX	0.6***	2.01***	0.86***
	(0.26)	(3.21)	(0.25)		(0.03)	(0.25)	(0.04)
BOL	0.76	1.84	0.76**	MAR	0.75***	2.46***	1.23***
	(0.24)	(2.32)	(0.1)		(0.02)	(0.12)	(0.05)
BRA	0.69	1.55***	0.86***	NAM	0.8***	3.02***	1.3***
	(0.12)	(0.5)	(0.04)		(0.02)	(0.06)	(0.06)
BGR	0.65	1.74	0.86	NPL	0.71***	1.68***	0.72***
	(0.24)	(3.77)	(0.1)		(0.04)	(0.38)	(0.07)
BDI	0.84***	2.7***	1.3***	NLD	0.63***	1.78*	0.9
	(0.04)	(0.12)	(0.08)		(0.02)	(1.03)	(0.07)
CAN	0.64	1.75	0.85***	NZL	0.56	1.92***	0.82***
	(0.11)	(2.18)	(0.05)		(0.04)	(0.15)	(0.03)
CHL	0.99***	0.66***	1.01	NOR	0.71***	2.69***	0.96
	(0.07)	(0.14)	(0.06)		(0.04)	(0.12)	(0.1)
COL	0.5	1.25***	0.73***	PAK	0.71	1.75	0.86***
	(0.03)	(0.08)	(0.02)		(0.22)	(2.51)	(0.02)
CRI	0.74	1.8	0.85	PAN	0.76	1.59**	0.89***
	(0.36)	(3.6)	(0.14)		(0.17)	(0.78)	(0.03)
CZE	0.57**	2.4***	0.79***	PNG	0.84***	3.07***	1.26
	(0.03)	(0.08)	(0.05)		(0.03)	(0.17)	(0.17)
DNK	0.61***	1.95***	0.87**	PRY	0.66***	2.42***	0.95
	(0.02)	(0.22)	(0.06)		(0.06)	(0.25)	(0.16)
DOM	0.56	1.37***	0.79***	PER	0.81**	1.15***	0.91
	(0.04)	(0.16)	(0.04)		(0.15)	(0.3)	(0.08)
ECU	0.68	1.84	0.74	PHL	0.61	1.67	0.89***
	(0.58)	(8.12)	(0.25)		(0.33)	(4.69)	(0.04)
EGY	0.77***	2.51***	1.28***	POL	0.57***	1.78***	0.84***
	(0.02)	(0.13)	(0.07)		(0.01)	(0.39)	(0.04)
ETH	0.84	1.47	1.11	PRT	0.52	1.87***	0.64***
	(0.24)	(1.21)	(0.07)		(0.04)	(0.19)	(0.05)
FIN	0.57***	2.11***	0.75***	ROU	0.76***	1.22***	0.74***
	(0.03)	(0.16)	(0.06)		(0.08)	(0.18)	(0.1)
FRA	0.54	1.88***	0.63***	RUS	0.62***	2.37***	0.88***
	(0.03)	(0.16)	(0.05)		(0.03)	(0.08)	(0.03)
GHA	0.76***	1.33***	0.94	ZAF	0.72***	2.61***	1.02
	(0.09)	(0.26)	(0.05)		(0.03)	(0.12)	(0.09)
GRC	0.72	1.77	0.89	ESP	0.57*	1.28***	0.83***
	(3.42)	(37.78)	(1.58)		(0.04)	(0.09)	(0.03)
GTM	0.61***	2.26***	0.68***	SWZ	0.91***	3.46***	1.83***
	(0.03)	(0.13)	(0.05)		(0.09)	(0.31)	(0.32)
HND	0.78***	2.26***	1.02	SWE	0.63***	1.85***	0.76***
	(0.02)	(0.34)	(0.1)		(0.03)	(0.53)	(0.07)
HUN	0.82	1.74	0.94	THA	0.62*	1.44***	0.64***
	(3.65)	(27.12)	(0.85)		(0.07)	(0.09)	(0.07)
IND	0.63***	2.32***	0.83**	TUN	0.59	1.58	0.95**
	(0.02)	(0.07)	(0.07)		(0.1)	(1.22)	(0.02)
IDN	0.63	1.37***	0.88***	TUR	0.64***	2.35***	0.75***
	(0.09)	(0.12)	(0.04)		(0.03)	(0.05)	(0.08)
IRL	0.69	1.81	0.81	GBR	0.64***	1.28***	0.85**
	(0.48)	(6.01)	(0.21)		(0.04)	(0.12)	(0.06)
ITA	0.81**	1.98	0.73	USA	0.62***	1.78**	0.84***
	(0.13)	(1.61)	(0.24)		(0.03)	(0.82)	(0.04)
CIV	0.77	1.77	1.04	URY	0.86*	1.09**	0.92
	(0.22)	(2.32)	(0.17)		(0.21)	(0.44)	(0.1)
JPN	0.77*	1.88	0.73*	VEN	0.84***	3.15***	1.46***
	(0.15)	(1.81)	(0.15)		(0.02)	(0.09)	(0.1)
JOR	0.85***	2.95***	1.53***	ZMB	1***	1.07***	1.16**
	(0.03)	(0.2)	(0.14)		(0.11)	(0.39)	(0.07)

Note: In this table we report estimated parameter values of $\hat{\theta}_i$, $\hat{\alpha}_i$, and $\hat{\gamma}_i$. Standard errors are reported in brackets. We denote with *** significance at 1 percent, with ** significance at 5 percent, and with * significance at 10 percent. Specifically, we tested the following null hypothesis $\theta = 0.5$, $\alpha = 0$, $\gamma = 1$.

Figure 3 – Scatterplot of estimated parameters andproxies of transparency and conflict



(a) Estimated α vs Trasparency

(b) Estimated θ vs Conflict

Note: In this Figure we plot the relationship between our estimates of political frictions (y-axis) and their data proxies (x-axis). In the left panel we plot the estimated degree of transparency ($\hat{\alpha}_i$) and the proxy $Transp_i$ as defined in section 2. In the right panel we plot the estimated degree of political conflict ($\hat{\theta}$) and the proxy $Confl_i$ as defined in section 2. The solid lines are regression lines.

1. **Specification Error:** The model considered in this paper is a rather stylized model of consumption smoothing, in which output is exogenous (i.e. no production), financial markets are competitive, debt contracts are fully enforceable, there are only two possible shocks (to domestic output and to reelection probability) so other relevant internal or external sources of risk are ignored. Whenever these missing features are actually relevant in determining the empirical moments that we have employed in our estimation strategy (i.e. re-election probability, level of debt, and consumption and trade balance variances), then the estimated parameters $\{\hat{\Theta}_i\}$ may differ from their real value. For example, suppose that debt to GDP is larger in country i than in country j because of different demographic structures that result in different costs of the pension system. Since this element is not present in our model, country i would result as more politically frictioned compared to country j.

2. **Measurement Error:** Another potential source of error comes from the unobservability of the real structural parameters. The proxies for lack of transparency and political conflicts proposed in Section 2 are only imperfect measures of the real institutional frictions. For example, to proxy political conflict we averaged different measures of fractionalization following the literature. As explained in Section 2, the existence of fractionalization might not necessarily imply that a conflict between parties exists. Observing more accurate measures of conflict would reduce the measurement error arising from comparing the structural parameter θ implied and its data proxies. Similarly,

we do not observe the degree of lack of transparency, which relates to the degree of retrospective voting in our model, in each country but only possible determinants of the existence of this phenomenon.

Given the argument above, the imperfect fitting resulting in the scatters of Figure 3a and 3b may result from estimating a too stylized model and from comparing the estimates to imprecise proxies. Removing these sources of the errors is not an easy task and it would ideally require developing a richer model or observing different data. Nevertheless, in what follows we try to correct for these possible errors and to investigate whether, when addressing them, the relationship between the data and the estimates becomes stronger or weaker. To address this point we proceed by adding potential omitted factors in the regression of $\hat{\Theta}$, i.e. the structurally estimated parameters of interest, on their proxies from the data, and then testing whether Specification errors and Measurement errors alter the positive relationship between estimated parameters and data proxies. To address the Specification error, we include the same control variables that have used to test the cross section of debt in equation (1). To address the Measurement error we included alternative proxies of conflict and transparency that could help in reaching a more accurate measure of the proxies. Hence, we run the following regressions:

$$\hat{\alpha}_i = \gamma_0 + \gamma_1 Transp_i + \gamma_s X_i^s + \gamma_m Z_i^{m,\alpha} + \eta_i; \tag{21}$$

$$\hat{\theta}_i = \psi_0 + \psi_1 Conflict_i + \psi_s X_i^s + \psi_m Z_i^{m,\theta} + \nu_i; \tag{22}$$

where $Conflict_i$ and $Transp_i$ are the proxies defined in Section 2, X_i^s are the control variables used in the regression (1) and that aim to capture the Specification error, $Z^{m,\alpha}$ and $Z^{m,\theta}$ are control variables that aim to capture the Measurement errors for α and θ, respectively, and η_i and ν_i are *iid* disturbances.

In Table 6 we present the results for the regression for transparency in equation (21). In column one (Univariate) we present the univariate regression corresponding to the solid regression line in figure 3a: as expected the coefficient is positive and strongly significant, although the fit is not excellent, since the R^2 is below 0.1. In column 2 (Spec.) we address the Specification error by including a selection of most significant control variables of regression (1). Recall that these control variables aim to capture possible determinants of debt levels that are not included in our model. Accounting for the Specification error improves quite substantially the fit, since the R^2 increases to 0.36, but, importantly, it does not alter the significant and strong positive relationship between the estimated degree of lack of transparency, and its data counterpart. In column 3 (Meas.) we analyze the role of an alternative

determinant of lack of transparency, that is education, to reduce potential measurement error. We have included two different variables that capture education levels: *Primary Education* is the average of primary education enrolment rate between males and females; *Students* is the number of students at universities or other higher education institutions per 10 millions inhabitants. These proxies of literacy and higher education may affect the degree of retrospective voting as Transparency does. While Transparency represents information frictions on government actions arising from the political environment and media power, lack of education could induce retrospective voting from the side of the voters. As column 3 shows, these additional variables are not significant and do not contribute to improving the fit. Nevertheless, the coefficients have intuitive signs: larger levels of literacy and education are correlated with low levels of $\hat{\alpha}$, that is lower level of lack of transparency. Notice, that even when addressing the Measurement error, the statistically significant positive relationship between $\hat{\alpha}$, and the proxy of lack of transparency still holds. Finally in column 4 (Complete) we regress $\hat{\alpha}$ on our benchmark proxy of lack of transparency and both groups of controls included to capture the Specification and Measurement error. Transparency is still significant and positively associated with $\hat{\alpha}$ even in the complete specification.

In Table 7 we present the results for the regression for political friction in equation (22). As before, in the first column (Univariate) we present univariate regression of $\hat{\theta}$ on $Conflict$. As expected the slope is positive and significant. In the second column (Spec.) we present multivariate regression with the same controls included in table 6. In contrast with the α case, the controls that account for the the Specification error are not significant; furthermore, the relation between the estimate $\hat{\theta}$ and the proxy of political conflict becomes not significant, albeit still positive. In column 3 (Meas.) we add only controls for the measurement error, i.e. a measure of dictatorship (No Party allowed) aimed to capture a degree of political friction that is not embodied in fractionalization, the Gini index[16], as a measure of economic inequality, and political killings, which is a measure of realized conflict. We find that measurement controls are strongly significant and improve substantially the fit. Importantly, the significant positive relationship between estimated parameters and our benchmark proxies holds. The same conclusion applies when estimating the complete regression.

To summarize, we found that the estimated institutional parameters in our model, i.e. political conflict and lack of transparency, are positively correlated with the proxies that have been found to explain the cross section of debt-to-gdp across countries. The positive relationship holds when controlling for possible specification errors of the model and measurement

[16]Remember that, in our model, larger θ implies larger distribution of consumption to the incumbent's party, which results in greater inequality.

Table 6 – Estimated α and Lack-of-Trasparency

	Univariate	Spec.	Meas.	Complete
Constant	1.74**	-1.21	2.46***	-1.82
	(16.39)	(-1.18)	(3.56)	(-1.52)
Lack-of-Transp.	0.58**	0.79**	0.58*	0.67**
	(2.23)	(2.31)	(1.85)	(2.01)
Energy		0.38**		0.39**
		(2.36)		(2.43)
Business		0**		0.01***
		(2.03)		(2.76)
GDP per capita		0.23**		0.41***
		(2.31)		(3.34)
Majoritarian		0.32*		0.41**
		(1.84)		(2.18)
Openness		0.6***		0.54***
		(3.14)		(2.87)
Primary edu.			-0.01	-0.01
			(-1.23)	(-1.25)
Students			0.01	-0.03**
			(0.6)	(-2.06)
R^2	0.07	0.36	0.1	0.42
$\bar{R}^2$	0.06	0.29	0.05	0.33
DW	2.46	2.42	2.43	2.48
N	66	66	66	66
F	5.4	3.09	6.77	0
Pvalue F	0.00	0.05	0.00	1

Note: This table presents the results of regression (21). The univariate regression displays the link between estimated degree of lack-of transparency, $\hat{\alpha}_i$ and its proxy observed in the data, $Transp_i$. The regression labelled Spec includes control variables X_i^s that capture the Specification error. The regression labelled Meas. includes control variables $Z_i^{m,\theta}$ that capture the Measurement error. The final regression is the complete regression.

errors in the proxy. Our preliminary analysis supports the idea that a less stylized model would probably help in improving the link, but we nevertheless found support that indeed lack of transparency and political conflict can be an important determinant of observed heterogeneity of debt levels across countries.

6 Conclusion

In this paper we study the relationship between cross-country sovereign debt, lack of transparency and political conflicts. Our first set of results is empirical. Whereas these two variables, *per-se*, are not significant determinants of observed debt levels across countries, their interaction is a key factor to explain debt-levels heterogeneity. In fact, whereas the sim-

Table 7 – Estimated θ vs Political Conflict

	Univariate	Spec.	Meas.	Complete
Constant	0.5***	0.67**	0.27**	0.43
	(5.15)	(2.32)	(2.23)	(1.51)
Political Conflict	0.31**	0.2	0.31**	0.28*
	(2.18)	(1.29)	(2.33)	(1.87)
Energy		0.02		0.03
		(0.44)		(0.84)
Business		0.05		0.06
		(1.04)		(1.34)
GDP per capita		-0.02		-0.03
		(-0.96)		(-1.1)
Majoritarian		-0.01		0.00
		(-0.2)		(-0.13)
Openness		0.08*		-0.01
		(1.82)		(-0.13)
No Parties Allow.			0.23***	0.17**
			(3.68)	(2.42)
Gini index			0.37***	0.34**
			(2.71)	(2.36)
Political killings			0.04*	0.09***
			(1.7)	(2.76)
R^2	0.07	0.22	0.31	0.4
$\bar{R}^2$	0.05	0.14	0.27	0.3
DW	2.05	2.01	1.85	1.93
F	4.37	5.77	1.76	0.00
Pvalue F	0.00	0.00	0.13	0.00
N	66	66	66	66

Note: This table presents the results of regression (22). The univariate regression displays the link between estimated degree of political conflict, $\hat{\theta}_i$ and its proxy observed in the data, $Confl_i$. The regression labelled Spec includes control variables X_i^s that capture the Specification error. The regression labelled Meas. includes control variables $Z_i^{m,\alpha}$ that capture the Measurement error. The final regression is the complete regression.

ple regression of debt levels on political conflict and lack of transparency yields insignificant coefficients, their interaction term is positive and significant. This implies that if political conflict increases in a transparent economy (low lack of transparency values), its effect on debt is negative (which means it incentivizes saving); on the contrary, in a non-transparent economy (high lack of transparency values) large political conflicts induce borrowing (more debt). This finding is a very robust feature, which holds when adding additional control variables and to a more complete second order regression. Then, we propose a model that can rationalize these findings. We incorporate political uncertainty into a conventional open-economy real business cycle model, and we also include political conflict and transparency. Regarding political conflict, similarly to Alesina and Tabellini (1990b), parties have preferences over distribution across different groups and decide the allocation of consumption according to

these preferences. Regarding lack of transparency, we assume that in more non-transparent economies, the probability of an incumbent to be re-elected is more strongly a function of current economic conditions. This model is able to generate the empirical findings explained above: in a transparent economy, political conflict generates savings, since an incumbent has a precautionary saving motive driven by political uncertainty. Nevertheless, lack of transparency incentivizes borrowing, since a higher amount of resources in the economy increase re-election probability. We then use the theoretical prediction of our model about macroeconomic aggregates to estimate the degree of the two frictions. Using a GMM approach, our strategy yields a cross section set of estimates for our two parameters of interest, the degree of political conflict and lack of transparency. Notice that we use only observed macroeconomic moments to estimate these frictions, without using any information about the actual degree of these frictions. Hence, the second natural step is to investigate how our estimates correlate, in the cross-section, with observed proxies of political conflict and lack of transparency. Our finding can be summarized as follows. First, the model strongly supports the existence of these frictions. Second, the estimated frictions positively and significantly relate to their data counterparts. Third, once one takes into account possible sources of bias, coming from observing imperfect measures of the frictions and from estimating the frictions with a stylized model that might ignore important effects, the positive relationship becomes even stronger. Hence, we are confident that the mechanism proposed in our model can rationalize the empirical importance of the interaction between political conflict and lack of transparency as observed in the data.

References

Acemoglu, D., M. Golosov, and A. Tsyvinski (2011): "Power fluctuations and political economy," *Journal of Economic Theory*, 146, 1009–1041.

Aguiar, M. and G. Gopinath (2007): "Emerging Market Business Cycles: The Cycle Is the Trend," *Journal of Political Economy*, 115, 69–102.

Alesina, A., A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg (2003): "Fractionalization," *Journal of Economic growth*, 8, 155–194.

Alesina, A. and A. Drazen (1991): "Why Are Stabilizations Delayed?" *American Economic Review*, 81, 1170–88.

Alesina, A., E. Glaeser, and B. Sacerdote (2001): "Why Doesn't the US Have a European-Style Welfare System?" Tech. rep., National Bureau of Economic Research.

Alesina, A. and E. Spolaore (1997): "On the Number and Size of Nations," *The Quarterly Journal of Economics*, 112, 1027–1056.

Alesina, A. and G. Tabellini (1990a): "A Positive Theory of Fiscal Deficits and Government Debt," *Review of Economic Studies*, 57, 403–14.

——— (1990b): "Voting on the Budget Deficit," *The American Economic Review*, 80, 37–49.

Altug, S., B. Neyapti, and M. Emin (2012): "Institutions and Business Cycles," *International Finance*, 15, 347–366.

Amador, M. and M. Aguiar (2011): "Growth dynamics in a small open economy under political economy frictions," 2011 Meeting Papers 1363, Society for Economic Dynamics.

Bartels, L. (2013): "Ideology and Retrospection in Electoral Responses to the Great Recession," Mimeo.

Beck, T., G. Clarke, A. Groff, P. Keefer, and P. Walsh (2001): "New tools in comparative political economy: The Database of Political Institutions," *The World Bank Economic Review*, 15, 165–176.

Boz, E., C. B. Durdu, and N. Li (2012): "Emerging Market Business Cycles: The Role of Labor Market Frictions," *IMF Working Paper*, WP/12/237.

Cingranelli, D. L. and D. L. Richards (2010): "The Cingranelli and Richards (CIRI) human rights data project," *Human Rights Quarterly*, 32, 401–424.

Cuadra, G. and H. Sapriza (2008): "Sovereign default, interest rates and political uncertainty in emerging markets," *Journal of International Economics*, 76, 78–88.

Debreu, G. and T. C. Koopmans (1982): "Additively decomposed quasiconvex functions," *Mathematical Programming*, 24, 1–38.

Easterly, W. and R. Levine (1997): "Africa's growth tragedy: policies and ethnic divisions," *The Quarterly Journal of Economics*, 112, 1203–1250.

Garcia-Cicco, J., R. Pancrazi, and M. Uribe (2010): "Real Business Cycles in Emerging Countries?" *The American Economic Review*, 100, 2510–2531.

Gibney, M., L. Cornett, R. Wood, P. Haschke, and D. Arnon (2015): "The Political Terror Scale 1976-2015. Date Retrieved, from the Political Terror Scale website," *http://www.politicalterrorscale.org*.

Horowitz, D. L. (1985): *Ethnic groups in conflict*, University of California Pr.

Jaimovich, D. and U. Panizza (2010): "Public debt around the world: a new data set of central government debt," *Applied Economics Letters*, 17, 19–24.

Keefer, P. (2009): "Database of Political Institutions: Changes and Variable Definitions: Development Research Group: World Bank," .

Lewis-Beck, M. S. and M. Stegmaier (2000): "Economic determinants of electoral outcomes," *Political Science*, 3, 183.

Milesi-Ferretti, G. M., R. Perotti, and M. Rostagno (2002): "Electoral systems and public spending," *Quarterly Journal of Economics*, 609–657.

Nordhaus, W. D. (1975): "The political business cycle," *The Review of Economic Studies*, 42, 169–190.

Norris, P. (2009): "Democracy Timeseries Data Release 3.0," Tech. rep., John F. Kennedy School of Government, Harvard University.

Pacek, A. C. and B. Radcliff (1995): "Economic Voting and the Welfare State: A Cross-National Analysis," *The Journal of Politics*, 57, 44–61.

Prosperi, L. (2016): "Political Cost of Default and Business Cycle in Emerging Countries," .

Regan, P. and D. Clark (2010): "The institutions and elections project," *The QoG Social Policy Dataset, version 11Nov10. Retrieved May*, 14, 2011.

Reinhart, C. M. and K. S. Rogoff (2010): "From Financial Crash to Debt Crisis," NBER Working Paper 15795, National Bureau of Economic Research.

Rogoff, K. (1990): "Equilibrium Political Budget Cycles," *American Economic Review*, 80, 21–36.

Rogoff, K. and A. Sibert (1988): "Elections and macroeconomic policy cycles," *The Review of Economic Studies*, 55, 1–16.

Semlali, A. S. (1997): "Sources of Debt Accumulation in a Small Open Economy," *IMF Working Papers*, 97/146.

Shi, M. and J. Svensson (2006): "Political budget cycles: Do they differ across countries and why?" *Journal of Public Economics*, 90, 1367 – 1389.

Teorell, J., N. Charron, M. Samanni, S. Holmberg, and B. Rothstein (2011): "The quality of government dataset," *The Quality of Government Institute University of Göteborg. Göteborg.*

Uribe, M. (2013): *Open Economy Macroeconomics*, www.columbia.edu/ mu2166.

Uribe, M. and V. Yue (2006): "Country spreads and emerging countries: Who drives whom?" *Journal of International Economics*, 69, 6–36.

Vanhanen, T. (2004): *Democratization: A comparative analysis of 170 countries*, Routledge.

White, H. (1980): "A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity," *Econometrica: Journal of the Econometric Society*, 817–838.

A Appendix: Data Source

Institutional variables come from different sources that are collected in the Quality of Government dataset Teorell et al. (2011).

A.1 Debt-to-GDP

Debt to GDP data has been collected from Reinhart and Rogoff (2010) and Jaimovich and Panizza (2010). From Reinhart and Rogoff (2010) we took debt to GDP measured as the share of total gross general public debt (domestic and external) over gross domestic product, last year available 2010.[17] Country coverage has been extended by using the dataset of Jaimovich and Panizza (2010) at the cost of fewer observation in the time-dimension (until 2005), where the debt data refers to gross central (as opposite to general) government debt and for this reason it is not fully comparable with the data in Reinhart and Rogoff (2010). Gross domestic product is extracted from the World Bank dataset, is calculated at constant local currency prices. In fact, from this dataset we can also include the following countries: Bangladesh, Burundi, Czech Republic, Ethiopia, Jordan, Latvia, Namibia, Nepal, Pakistan, Papua New Guinea, Swaziland.

A.2 Transparency proxies

- *Functioning of Government (FOG)*: This variable examines to what extent the freely elected head of government and a national legislative representative determine the policies of the government; if the government is free from pervasive corruption; and if the government is accountable to the electorate between elections and operates with openness and transparency. Countries are graded from the worst to the best.
- *Freedom of Expression and Belief (FEB)*: This variable measures the freedom and independence of the media and other cultural expressions; the freedom of religious groups to practice their faith and express themselves; the academic freedom and freedom from extensive political indoctrination in the educational system; and the ability of the people to engage in private (political) discussions without fear of harassment or arrest by the authorities. Countries are graded from the worst to the best.

The source for the two variables is Freedom House. https://freedomhouse.org. Other proxies from this source have been used to define an alternative transparency index that has been used in regression (12) of table 2.

A.3 Political conflict proxies

- *Ethnic, linguistic and religious fractionalization*: Fractionalization expresses the probability that two randomly selected individuals from the population will not belong to the same ethnic/linguistic/religious group. Source Alesina et al. (2003)
- *Political Killings and Imprisonment*: These proxies measure the frequency of political killings and imprisonment. Source Human Rights Dataset Cingranelli and Richards (2010)

[17] We made few exception due to data availability. In Tunisia we choose total non-financial public sector debt over GDP, while for UK we choose net central public debt over GDP

- *Political Terror Scale*: It measures levels of political violence and terror that a country experiences in a particular year based on a 5-level "terror scale" originally developed by Freedom House. The two measures differs from the original data source used to calculate the index: the yearly country reports of Amnesty International, the U.S. State Department Country Reports on Human Rights Practices: Source Gibney et al. (2015).

A.4 Control Variables in Regression 1

- *Credit*: domestic credit provided by the banking sector. Source World Development Indicators (WDI)
- *GPDpc*: GDP per capita. Source WDI
- *GDP growth*: annual growth rate of GDP per capita. Source WDI
- *Openness*: sum of export and imports over GDP. Source Penn world tables
- *Majoritarian*: fraction of years in which the country had majoritarian system. Source Norris (2009)
- *Energy*: per-capita energy production. Source WDI
- *Business*: variable easiness of doing business. Source WDI
- *Pop>65*: share of the population over 65 years old. Source WDI

A.5 Data for the moments used in GMM

Output is GDP per capita in local currency. Consumption is calculated by multiplying GDP per capita and final consumption expenditure in percentage of GDP. Trade balance is calculated as the difference between output and consumption. Consumption and output are detrended using cubic polynomial. The source of macroeconomic data is WDI. Mean re-election probability is calculated as the average number of years in office of the chief executive, from the Database of Political Institutions (Beck et al. (2001) and Keefer (2009)).

A.6 Data for the Measurement Error regression

- *Primary Education*: average of primary education enrolment rate between males and females. Source Unesco
- *Students*: number of students at universities or other higher education institutions per 10 millions inhabitants. Source: Index of Power resources Vanhanen (2004)
- *No Parties Allowed*: For a single year the index takes value 1 if parties are not allowed. Source: Institutions and Elections Project Regan and Clark (2010).
- *Gini Index*: Source WDI

B Appendix: List of Countries

We collect public data from different sources of 66 economies listed in Table 8. Selected countries are strongly heterogenous in terms of economic development: we have included OECD economies, emerging

economies and developing economies. The choice of which country to include in the analysis that follows has been driven mainly by the existence of data on government debt over GDP.

Table 8 – List of Countries

Argentina	Greece	Pakistan
Australia	Guatemala	Panama
Austria	Honduras	Papa New Guinea
Bangladesh	Hungary	Paraguay
Belgium	India	Peru
Bolivia	Indonesia	Philippines
Brazil	Ireland	Poland
Bulgaria	Italy	Portugal
Burundi	Ivory Coast	Romania
Canada	Japan	Russia
Chile	Jordan	South Africa
Colombia	Kenya	Spain
Costa Rica	Korea	Swaziland
Czech Republic	Latvia	Sweden
Denmark	Malaysia	Thailand
Dominican Republic	Mexico	Tunisia
Ecuador	Morocco	Turkey
Egypt	Namibia	United Kingdom
Ethiopia	Nepal	United States
Finland	Netherland	Uruguay
France	New Zealand	Venezuela
Ghana	Norway	Zambia

C Appendix: Equilibrium

We describe the game as follows. We define the state vector $k \in K \in \mathbb{R}^4$ where $k_t = (t, d_t, y_t, \omega_t)$,[18] and $\omega_t \in \Re^{N+1}$ is a vector of indices s.t. $w_{i,t} = 1$ if i is the incumbent at period t and 0 otherwise $\forall i = 1, .., N+1$. Output y_t evolves exogenously, d_t is the level of debt inherited from past period, and ω_t is determined by the endogenous political markov process.

In this dynamic game, at each stage t of the game, the incumbent decides an action $a_{it} \in A^i(k_t)$ where $a_{it} = \left(d_{t+1}, c_t^{i,i}, \left\{c_t^{i,j}\right\}_{i \neq j}\right)$ if $\omega_{it} = 1$ and subject to the budget constraint in (3); instead the action profile of the opponents at t is empty: $a_{j,t} = A^j(k_t) = \emptyset$. Define an history $h^t \in \mathcal{H}^t$ as $h^t = (a_0, k_0, \ldots, a_t, k_t)$. A pure strategy for party i as incumbent I at time t is a function

$$\sigma_{i,t}: \quad \mathcal{H}^t \times K \to A_t$$

i.e. a mapping from the entire history and the current state space to each party actions at time t. We define as $\sigma_i = (\sigma_{i,1}, \ldots, \sigma_{i,T})$ the strategy profile of party i in the finite game, and $\sigma_i[t] = (\sigma_{i,t}, \ldots, \sigma_{i,T})$ the continuation strategy at time t. To be general let's define the intertemporal utility of party i in t as a function

[18] The time index t enters in the state representation because we are focusing on finite horizon

of the continuation strategy $W(\sigma_i[t], \sigma_{-i}[t])$. Defining S_i the set of all feasible σ_i, the strategy space of the infinite game is $S = \prod_{j=1}^{N+1} S_i$. We define the best response correspondence as:

$$BR(\sigma_i[t]|h^{t-1}, k_t) = \{\sigma_i[t] \in S_i[t]\},$$

such that

$$\sigma_i[t] \text{ maximizes } W(\sigma_i[t], \sigma_{-i}[t]),$$

given $\sigma_{-i}[t] \in S_{-i}[t]$.

A Sub-game Perfect Equilibrium of this game is defined as follows:

Definition 2. A **Sub-game Perfect Equilibrium** is a strategy profile $\sigma^* = (\sigma_1^*, \ldots, \sigma_{N+1}^*) \in S$ s.t. $\sigma_i^*[t] \in BR(\sigma_i[t]|h^{t-1}, k_t)$ for all (k_t, h^{t-1}), for all t and i.

In the rest of the paper we consider the more specific class of Markov Perfect Equilibria (MPE), where we restrict the strategies to be based only on *payoff-relevant* state, and not on the entire history of the game. In particular a Markov strategy is a mapping $\sigma \in \hat{S} \subset S$ s.t. $\sigma_i(k, h^{t-1}) = \sigma_i(k) \quad \forall h^{t-1} \in \mathcal{H}^{t-1}$.

Given the assumption of no discrimination and given that borrowing is completely independent from consumption allocation, it is natural to restrict our attention to the class of Symmetric MPE. In such a case the consumption level decided by the incumbent doesn't change with her identity, furthermore there is no discrimination between different groups at the opposition. As discussed in section 3.1, in such a case we can then define the instantaneous utility evaluated in $c^*(c)$ as $U^I(c_t) = \mathcal{U}^{i,i}(c_t^*)$ and $U^O(c_t) = \mathcal{U}^{i,r}(c_t^*)$. Defining as $\bar{p}_{t,s}$ the conditional probability for the party being in power at t to be in power also in s, the discounted utility is defined as

$$W(\sigma[t]) = \mathbb{E}_t \left[\sum_{s=t}^{T} \beta^t \left\{ \bar{p}_{t,s} U^I(c_t) + (1 - \bar{p}_{t,s}) U^O(c_t) \right\} \right] \tag{23}$$

Definition 3. A **Symmetric Markov Perfect Equilibrium** of this game is a strategy profile $\sigma^* = (\sigma_1^*, \ldots, \sigma_{N+1}^*) \in \hat{S}$ s.t.

1. $\sigma_i^*[t] \in BR(\sigma_i[t]|k_t)$ for all k_t, for all t and i,
2. $\forall k, \tilde{k} \in K$ s.t. $k = (t, d, y, \omega)$ and $\tilde{k} = (t, d, y, \tilde{\omega})$, where $\omega \neq \tilde{\omega}$, $\Rightarrow \sigma_{i,t}(k) = \sigma_{j,t}(\tilde{k}) \in \hat{S}$ where $\omega_i = \tilde{\omega}_j = 1$.

Conditions 1 and 2 state that only output realization and debt level at t matter for defining the equilibrium. This assumption clearly reduces the dimensionality of the problem by excluding past history. Now we can easily characterize the equilibrium. Since we are considering Symmetric MPE with our set of assumptions, we can solve the sharing static problem given the total amount of resources available in the economy for consumption c. Given the definition of $U^I(c)$ as in (2), we can also define as c_t^I the consumption assigned to the incumbent party I at time t and as $c_t^O = \frac{c_t - c_t^I}{N}$ the consumption level assigned to every opponent party. The sharing rule solves:

$$\max_{c_t^I} \left[\theta u\left(c_t^I\right) + \sum_{j \neq} \frac{1-\theta}{N} u\left(\frac{c_t - c_t^I}{N}\right) \right],$$

s.t. $c_t = c_t^I + Nc_t^O$. The following first order condition characterizes the optimal allocation:

$$\theta u'\left(c^I\right) = \frac{(1-\theta)}{N} u'\left(\frac{c_t - c_t^I}{N}\right).$$

The sharing rule is independent from the intertemporal decision due to the time-separability of the objective function of the incumbent and due to the fact that in a SPE following a different rule from (6) is a dominated strategy in the stage game. In the following we disregards the possibility of cooperation between parties. Since the optimal sharing rule is only a function of the aggregate consumption, then the action space can be reduced to the pair $a_{it} = (d_{t+1}, c_t)$ if $\omega_{it} = 1$. Given that (3) must be satisfied, the incumbent has only to decide the level of debt to carry to next period, $d_{t+1}(d_t, y_t)$, as a function of d_t and y_t.

D Appendix: Proofs

D.1 Proof of Proposition 1

Proof. • Part 1: $(a \Leftrightarrow c)$. Using equations (8) and (9), the RHS of the Euler equation in (7), can be written as:

$$\begin{aligned}
\left[\begin{array}{c} pU^{I'}(y-(1+r)d_2)+ \\ +(1-p)\,U^{O'}(y-(1+r)d_2) \end{array}\right] &= \left\{\begin{array}{c} p\left(\theta u'\left(c_2^I\right)\frac{\partial c^I(c_2)}{\partial c} + \frac{(1-\theta)}{N}u'\left(c_2^O\right)\left(1-\frac{\partial c^I(c_2)}{\partial c}\right)\right)+ \\ (1-p)\left(\frac{1}{N}\left(1-\frac{1-\theta}{N}\right)u'\left(c_2^O\right)\left(1-\frac{\partial c^I(c_2)}{\partial c}\right)+\frac{(1-\theta)}{N}u'\left(c_2^I\right)\frac{\partial c^I(c_2)}{\partial c}\right) \end{array}\right\} \\
&= \frac{\partial c^I(c_2)}{\partial c}\gamma u'\left(c_2^I\right) + \left(1-\frac{\partial c^I(c_2)}{\partial c}\right)\left(\frac{1-\gamma}{N}\right)u'\left(c_2^O\right),
\end{aligned}$$

where we have defined $\gamma = \left(p\theta + (1-p)\frac{1-\theta}{N}\right)$. Since, $\theta \geq (N+1)^{-1}$, then $\gamma \leq \theta$.

Similarly, the LHS of the Euler equation in (7) is:

$$U^{I'}(y-(1+r)\,d_1+d_2) = \frac{\partial c^I(c_1)}{\partial c}\theta u'\left(c_1^I\right) + \left(1-\frac{\partial c^I(c_1)}{\partial c}\right)\frac{(1-\theta)}{N}u'\left(c_1^O\right).$$

Notice that $\frac{\partial c^I(c)}{\partial c}$ can be derived by applying the implicit function theorem on the optimal sharing rule in equation (6), which gives:

$$\psi(c) = \frac{\partial c^I(c)}{\partial c} = \frac{\frac{1-\theta}{N^2}u''\left(\frac{c-c^I}{N}\right)}{\theta u''(c^I) + \frac{1-\theta}{N^2}u''\left(\frac{c-c^I}{N}\right)}. \tag{24}$$

From this expression it is clear that $0 \leq \frac{\partial c^I}{\partial c} \leq 1$. In the following, we omit to make explicit the dependency of ψ from aggregate consumption. Let's now evaluate the Euler Equation above at d_2^*, which is the solution of the benchmark (transparent and no-conflict) economy, i.e.

$$U^{I'}(y-(1+r)\,d_1+d_2^*) = \left[\begin{array}{c} pU^{I'}(y-(1+r)d_2^*)+ \\ +(1-p)\,U^{O'}(y-(1+r)d_2^*) \end{array}\right]$$

Recall that d_2^* implies that $c_1 = c_2$, and, therefore, $\psi(c_1) = \psi(c_2)$, $c_1^I = c_2^I$, and $c_1^O = c_2^O$. Therefore, we can use the expressions for the LHS and RHS derived above and we can then eliminate the time

subscripts. Since the utility function is concave, then we have that political conflict implies incentive to save (i.e. $\tilde{d}_2^* \leq d_2^*$), if and only if:

$$\psi\gamma u'\left(c^I\right) + (1-\psi)\frac{(1-\gamma)}{N}u'\left(c^O\right) \geq \psi\theta u'\left(c^I\right) + (1-\psi)\frac{(1-\theta)}{N}u'\left(c^O\right),$$

which can be rearranged as:

$$\underbrace{(\theta-\gamma)}_{\geq 0}\left((1-\psi)u'\left(c^O\right) - N\psi u'\left(c^I\right)\right) \geq 0. \tag{25}$$

By the optimal sharing rule in (6), we also have that: $u'\left(c^O\right) = \frac{N\theta}{1-\theta}u'\left(c^I\right)$. Hence, :

$$(\theta-\gamma)\,u'\left(c^I\right)N\left((1-\psi)\frac{\theta}{1-\theta} - \psi\right) \geq 0.$$

This inequality is satisfied if and only if $\theta > \psi$.

- Part 2: ($c \Leftrightarrow b$). Statement b is:

$$U^{I'}(c) \leq U^{O'}(c)$$

Using the definition of ψ and equations (8) and (9), it becomes:

$$\theta u'(c^I)\psi + \frac{1-\theta}{N}u'\left(c^O\right)(1-\psi) - \left(\frac{1-\theta}{N}u'(c^I)\psi + \frac{1}{N}\left(1-\frac{1-\theta}{N}\right)u'\left(c^O\right)(1-\psi)\right) \leq 0$$

$$\frac{N\theta-1+\theta}{N}\left[N\psi u'(c^I) - (1-\psi)u'(c^O)\right] \leq 0$$

Since $\theta \geq (N+1)^{-1}$, the condition is satisfied if the term in squared brackets is negative. Notice that this condition is equivalent to the one used in (25). Hence, as before, by using the optimal sharing rule in (6) we have that the condition is satisfied if and only if $\theta \geq \psi$.

- Part 3: ($c \Leftrightarrow d$). Condition c states that: $\theta \geq \frac{\partial c^I}{\partial c}$. Applying the implicit function theorem on the optimal sharing rule in equation (6), that condition is:

$$\theta \geq \frac{\partial c^I}{\partial c} = \frac{\frac{1-\theta}{N^2}u''\left(\frac{c-c^I}{N}\right)}{\theta u''(c^I) + \frac{1-\theta}{N^2}u''\left(\frac{c-c^I}{N}\right)}.$$

Using the definition: $c^O = \frac{c-c^I}{N}$ and the fact that $u''(\circ) < 0$, the condition becomes:

$$u''(c^I) \leq \left(\frac{1-\theta}{N\theta}\right)^2 u''(c^O).$$

The optimal sharing rule in (6) implies that:

$$\frac{1-\theta}{N\theta} = \frac{u'(c^I)}{u'(c^O)}.$$

Substituting into the equation above, and again considering that $u''(\circ) < 0$, then we have:

$$\frac{u''(c^O)}{u''(c^I)} \leq \left(\frac{u'(c^O)}{u'(c^I)}\right)^2$$

□

D.2 Proof of Corollary 2

Proof. Consider the optimal sharing rule in equation (6). Applying the inverse of the utility function to both sides of the equation, we have:

$$u'^{-1}\left(\theta u'\left(c^I\right)\right) = u'^{-1}\left(\frac{(1-\theta)}{N} u'\left(\frac{c-c^I}{N}\right)\right).$$

Assuming that condition (11) is satisfied, we have:

$$h\left(\theta\right) u'^{-1}\left(u'\left(c^I\right)\right) + l\left(\theta\right) = h\left(\frac{(1-\theta)}{N}\right) u'^{-1}\left(u'\left(\frac{c-c^I}{N}\right)\right) + l\left(\frac{(1-\theta)}{N}\right).$$

Labelling some terms for convenience, we obtain:

$$\underbrace{h\left(\theta\right)}_{\kappa_1} c^I + \underbrace{l\left(\theta\right)}_{\iota_1} = \underbrace{h\left(\frac{(1-\theta)}{N}\right)}_{\kappa_2} \frac{c-c^I}{N} + \underbrace{l\left(\frac{(1-\theta)}{N}\right)}_{\iota_2}.$$

Solving for c^I, we have:

$$c^I = \frac{\kappa_2}{N\kappa_1 + \kappa_2} c + \frac{N(\iota_2 - \iota_1)}{N\kappa_1 + \kappa_2}.$$

It follows that:

$$\frac{\partial c^I}{\partial c} = \frac{\kappa_2}{N\kappa_1 + \kappa_2} = \psi.$$

Since ψ is only a function of parameters of the model, then the utility function $u(c)$ satisfies the PSR property.

□

D.3 Proof of Corollary 3

Proof. According to corollary 2, we only need to test condition 11 on the marginal utility of the HARA utility functions, i.e.

$$u'(c) = a\left(\frac{ac}{\sigma} + b\right)^{-\sigma}.$$

In particular the inverse of the marginal utility of HARA utility can be written as:

$$c = g(\bar{u}) = \bar{u}^{-\frac{1}{\sigma}} \underbrace{\sigma a^{\frac{1-\sigma}{\sigma}}}_{r} - \underbrace{b\sigma a^{-1}}_{s} = \bar{u}^{-\frac{1}{\sigma}} r - s.$$

We can now show that property (11) holds:

$$g(\epsilon\bar{u}) = \epsilon^{-\frac{1}{\sigma}}\bar{u}^{-\frac{1}{\sigma}} r - s = \epsilon^{-\frac{1}{\sigma}}\bar{u}^{-\frac{1}{\sigma}} r - s + \epsilon^{-\frac{1}{\sigma}} s - \epsilon^{-\frac{1}{\sigma}} s = \underbrace{\epsilon^{-\frac{1}{\sigma}}}_{h(\epsilon)} \underbrace{(\bar{u}^{-\frac{1}{\sigma}} r - s)}_{g(\bar{u})} + \underbrace{s\left(\epsilon^{-\frac{1}{\sigma}} - 1\right)}_{l(\epsilon)}.$$

Hence, any HARA utility function satisfies the PSR property. □

D.4 Proof of Corollary 4

Proof.

- Part (a). Let us begin with part (a) of the corollary. In case of CRRA utility, it can be easily checked that the sharing rule is the following $c^I = \psi c$. In fact, by using equation (24) considering that $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$ and by using the optimal sharing rule in (6), we have that $c^I = \psi c$, with:

$$\psi = \frac{\left(\frac{\theta}{1-\theta}\right)^{\frac{1}{\sigma}} N^{\frac{1-\sigma}{\sigma}}}{1 + \left(\frac{\theta}{1-\theta}\right)^{\frac{1}{\sigma}} N^{\frac{1-\sigma}{\sigma}}}.$$

- Part (b). The inequality $\theta \geq \psi = \frac{\left(\frac{\theta}{1-\theta}\right)^{\frac{1}{\sigma}} N^{\frac{1-\sigma}{\sigma}}}{1+\left(\frac{\theta}{1-\theta}\right)^{\frac{1}{\sigma}} N^{\frac{1-\sigma}{\sigma}}}$ is satisfied for:

$$1 - \left(\frac{N\theta}{1-\theta}\right)^{\frac{1-\sigma}{\sigma}} \geq 0.$$

  which holds for $\sigma \geq 1$ and is satisfied with strictly inequality for $\sigma > 1$. Notice that in the log case ($\sigma = 1$), we have equality, i.e. $\theta = \psi$.

- Part (c). The result follows from part (b) above and from parts (a) and (c) of Proposition 1.

□

D.5 Proof of Corollary 5

Proof. At the optimal level of debt $\tilde{d}_2^*$, the Euler equation in (7) is satisfied, i.e.:

$$\theta\psi u'\left(c^I(y + \tilde{d}_2^* + d_1)\right) + (1-\psi)\frac{1-\theta}{N} u'\left(c^O(y + \tilde{d}_2^* + d_1)\right) = \psi\gamma u'\left(c^I(y - \tilde{d}_2^*(1+r))\right) + (1-\psi)\frac{(1-\gamma)}{N} u'\left(c^O(y - \tilde{d}_2^*(1+r))\right),$$

where we have used the expression for the Euler equation as derived in the proof D.1, and the definition of $\gamma = \left(p\theta + (1-p)\frac{1-\theta}{N}\right)$. Differentiating both sides for p, considering that by assumption ψ is a constant, we have:

$$\left[\theta\psi u''\left(c_1^I\right) + (1-\psi)\frac{1-\theta}{N} u''\left(c_1^O\right)\right]\frac{\partial\tilde{d}_2}{\partial p} = \frac{\partial\gamma}{\partial p}\left(\psi u'\left(c_2^I\right) - \frac{1-\psi}{N} u'\left(c_2^O\right)\right) - (1+r)\frac{\partial\tilde{d}_2}{\partial p}\left(\psi\gamma u''\left(c_2^I\right) + (1-\psi)\frac{1-\gamma}{N} u''\left(c_2^O\right)\right),$$

which gives:

$$\frac{\partial \tilde{d}_2}{\partial p} = \frac{\frac{\partial \gamma}{\partial p}\left(\psi u'\left(c_2^I\right) - \frac{1-\psi}{N}u'\left(c_2^O\right)\right)}{\left[\theta\psi u''\left(c_1^I\right) + (1-\psi)\frac{1-\theta}{N}u''\left(c_1^O\right)\right] + (1+r)\left(\psi\gamma u''\left(c_2^I\right) + (1-\psi)\frac{1-\gamma}{N}u''\left(c_2^O\right)\right)}$$

The denominator is negative because of the concavity of the utility function. Also, the first term in the numerator is positive, $\frac{\partial \gamma}{\partial p} > 0$, whenever $\theta > (N+1)^{-1}$. The term in brackets at the numerator is negative whenever $\theta > \psi$, as can be easily seen by optimal sharing rule in (6). By assumption, $U^{I'}(c) \leq U^{O'}(c)$, which indeed implies that $\theta > \psi$, by Proposition 1. Hence, $\frac{\partial \tilde{d}_2}{\partial p} < 0$, which means that an increase in p reduces saving incentive. Finally, notice that if $p = 1$, then $\gamma = \theta$, which is independent of p. Therefore $\frac{\partial \tilde{d}_2}{\partial p}|_{p=1} = 0$, and the Euler equation of the problem coincides with the Euler equation of the frictionless economy in 4. □

D.6 Sufficient conditions for the solution of FOC to be a global maximum

In this section we provides the sufficient conditions on the probability function $p(c)$ such that the equilibrium condition in (16) characterizes a unique global maximum.

Lemma 7. *Assuming that the utility function satisfies the PSR property and the conditions of Proposition 1. Then, if* $\forall d_2$

$$p'(c_1) < A_1(c_2) \tag{26}$$
$$p''(c_1) < A_2(c_1, c_2) \tag{27}$$

then the solution of the Euler Equation in equation (16) is a global solution of the problem (12)-(15). Here, $c_1 = y + d_2 - (1+r)d_1$, $c_2 = y - (1+r)d_2$, $\tau = (N\theta - 1 + \theta)/N$, *and* $A_1(c_2)$, $A_2(c_1, c_2)$ *are:*

$$A_1(c_2) = (1+r)\frac{\theta\psi^2 u''(\psi c_2) + (1-\theta)\left(\frac{1-\psi}{N}\right)^2 u''\left(\frac{1-\psi}{N}c_2\right)}{\tau\left[\psi u'(\psi c_2) - \frac{1-\psi}{N}u'\left(\frac{1-\psi}{N}c_2\right)\right]} > 0.$$

$$A_2(c_1, c_2) = -\frac{\theta\psi^2\left[u''(\psi c_1) + (1+r)u''(\psi c_2)\right]}{\beta\tau\left(u(\psi c_2) - u\left(\frac{1-\psi}{N}c_2\right)\right)} - \frac{(1-\theta)\left(\frac{1-\psi}{N}\right)^2\left[(1+r)(1-\theta)\left(\frac{1-\psi}{N}\right)^2 u''\left(\frac{1-\psi}{N}c_2\right) + (1-\theta)\left(\frac{1-\psi}{N}\right)^2 u''\left(\frac{1-\psi}{N}c_1\right)\right]}{\beta\tau\left(u(\psi c_2) - u\left(\frac{1-\psi}{N}c_2\right)\right)}$$

Proof. A sufficient condition for the solution of FOC to be a global maximum is that the RHS of the Euler equation in 16 is increasing in d_2 and the LHS decreasing in d_2. Notice that $U^{I'}(c) - U^{O'}(c) = \tau\left(u'(\psi c_1) - u'\left(\frac{1-\psi}{N}c_1\right)\right)$, where $\tau = (N\theta - 1 + \theta)/N$. Differentiating the RHS for d_2:

$$\frac{\partial RHS}{\partial d_2} = -(1+r)\left[\theta\psi^2 u''(\psi c_2) + (1-\theta)\left(\frac{1-\psi}{N}\right)^2 u''\left(\frac{1-\psi}{N}c_2\right)\right] + \underbrace{\tau p'(c_1)}_{\gamma'(c_1)}\left[\psi u'(\psi c_2) - \frac{1-\psi}{N}u'\left(\frac{1-\psi}{N}c_2\right)\right] > 0$$

Notice that the first term in squared brackets is negative because of the concavity of the utility function. Also, the second term in squared bracket is negative when $\theta > \psi$, as directly implied by optimal sharing rule in (6). Solving for $p'(c_1)$, we obtain the condition in (26). Differentiating the LHS of the Euler equation for d_2:

$$\begin{aligned}\frac{\partial LHS}{\partial d_2} =&\theta\psi^2 u''(\psi c_1) + (1-\theta)\left(\frac{1-\psi}{N}\right)^2 u''\left(\frac{1-\psi}{N}c_1\right) + \\ &+ \tau p'(c_1)\left[\psi u(\psi c_2) - \frac{1-\psi}{N}u\left(\frac{1-\psi}{N}c_2\right)\right] + \beta\tau p''(c_1)\left[u(\psi c_2) - u\left(\frac{1-\psi}{N}c_2\right)\right] < 0\end{aligned}$$

Rearranging terms and using (26) to determine an upper bound for $p'(c_1)$, we obtain the condition (27). □

D.7 Proof of Proposition 6

Proof. Part 1. If conditions (26) and (27) are satisfied, the unique equilibrium $\hat{d}_2^*$ in a non-transparent economy is given by equating the LHS and RHS of of the Euler equation in (16). In a transparent economy, the equilibrium $\tilde{d}_2^*$ is given by (7). Comparing the two conditions, notice that the right-hand sides are identical; hence, the marginal utility of savings is unchanged in the two case. Instead, the left-hand side of (16) has an additional term, which is: $\beta p'(c_1)\left[U^I(c_2) - U^O(c_2)\right]$. With a strictly positive degree of political conflict, i.e. $\theta > \frac{1}{N+1}$, that term is strictly positive if $p'(c_1) > 0$. That means that with a positive degree of lack of transparency, the marginal utility of consuming is larger than in a transparent economy. Therefore, it follows that $\tilde{d}_2^* > \hat{d}_2^*$.

Part 2. Now consider the solution d_2^* of the frictionless benchmark model that solves equation (4). Recall that d_2^* implies that $c_1 = c_2$, and, therefore, $\psi(c_1) = \psi(c_2)$, $c_1^I = c_2^I$, and $c_1^O = c_2^O$. Then, defining z the difference between RHS and LHS evaluated at d_2^*. z represents the difference between saving incentives and consuming incentives. Eliminating the time subscripts, we have:

$$z = \left(\theta - \gamma\left(c^I\right)\right) N\left[(1-\psi)\frac{\theta}{(1-\theta)} - \psi\right] u'\left(c^I\right) - p'(c)\left(\frac{N\theta - 1 + \theta}{N}\right)\left[u\left(c^I\right) - u\left(c^O\right)\right].$$

Differentiating, we have that $\frac{\partial z}{\partial p'(c)} < 0$. Since z is monotone, for a large enough $p'(c)$ then $z < 0$, which means that the solution in a non-transparent economy with political conflict implies larger borrowing incentives than the one in the frictionless economy.

□

D.8 The log-utility case with linear probability

In the log utility case we have already seen that there is no saving incentive for any level of θ when the probability of being re-elected is exogenous. Indeed in this case $\psi = \theta$ and $U^{I'}(c) = U^{O'}(c) = 1/c$. It is easy to notice also that $U^I(c) - U^O(c) = \tau(2\theta - 1)\left[\log\theta - \log(1-\theta)\right]$. The Euler Equation (16) becomes:

$$(y + d_1)^{-1} + p'(d_1)\beta\tau(2\theta - 1)\left[\log\theta - \log(1-\theta)\right] = (y - d_1(1+r))^{-1}.$$

In the linear probability case, i.e. $p'(d_1) = \alpha$, the optimal level of debt solves:

$$\frac{(y+d_1)}{(y-d_1(1+r))} = 1 + (y+d_1)\alpha\beta\tau\left[\log\theta - \log(1-\theta)\right] \tag{28}$$

In a non-transparent economy, $\alpha > 0$, the RHS of this equation is always greater than 1. Then $\tilde{d_1}$ that satisfies (28) is always positive. This implies that as far as $\alpha > 0$ we have borrowing in this economy. Therefore, the threshold level of $p'(c)$ that implies borrowing incentives with respect to the frictionless case is zero, in the log-utility case. We can also prove a more general statement: with CRRA utility function and with linear reelection probability, the threshold level for α, $\bar{\alpha}$ s.t. when $\alpha > \bar{\alpha}$ we have borrowing incentives with respect to the frictionless economy is independent from θ. In the body we showed numerically that this result is robust also to a more general form of probability function .

E Appendix: Equilibrium Debt and Non-linear Probability

Here we consider the following non-linear probability function: We assume that the probability of being re-elected is represented by the following functional form:

$$p(c) = \text{atan}\left(\frac{\alpha(c-\bar{c})+\gamma}{\pi}\right) + \frac{1}{2}. \tag{29}$$

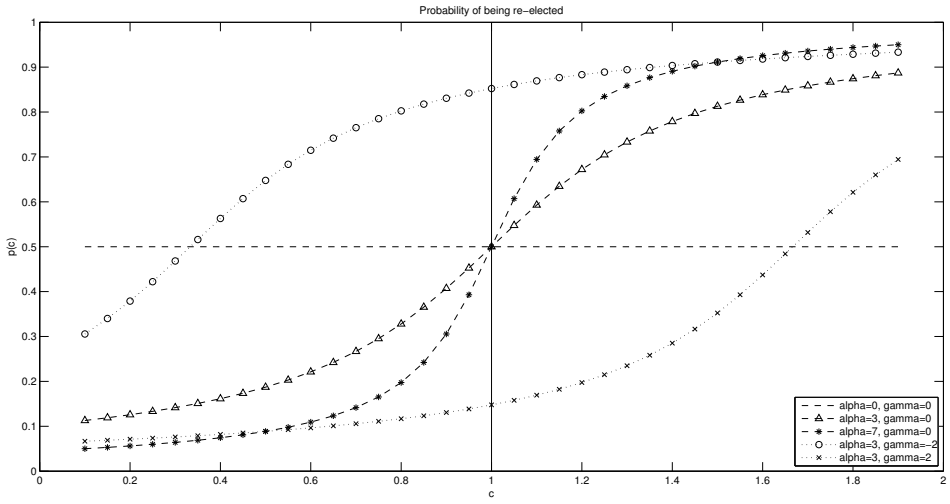
Figure 4 visualizes this probability function for different parameter values. Here, α affects the sensitivity (slope) of the probability function, whereas γ determines its level. By increasing α the probability becomes steeper around the flex. When α is very large the probability function is close to a step function. If γ is zero, the function is centered in $\bar{c}$. Adopting the function in (29) we assume that voters are more sensitive to economic conditions at the flex point. The flex point of the curve is shifted to the left (right) with respect to $\bar{c}$ when $\gamma > 0 (< 0)$. This function is bounded between 0 and 1 for any realization of consumption. The calibration of the model is as presented in section 3.7. In Figure 5 we plot the equilibrium level of debt for different combinations of θ and α in a 2-period model with CRRA utility function. In Table 9 we report the average equilibrium level of debt for different combinations of θ and α in a T-period model (with T=2250).

Table 9 – Equilibrium Level of Debt in a T-period economy: Non-linear Probability

	α				
	0	1	3	5	7
θ=0.5	0	0	0	0	0
θ=0.6	-1.2	0	0.4	5.1	9.9
θ=0.7	-4.3	-0.2	11.4	23.3	30.6
θ=0.8	-2.3	0.8	30.3	30.9	98.1
θ=0.9	-4.8	-1.2	9.3	256.7	440.4

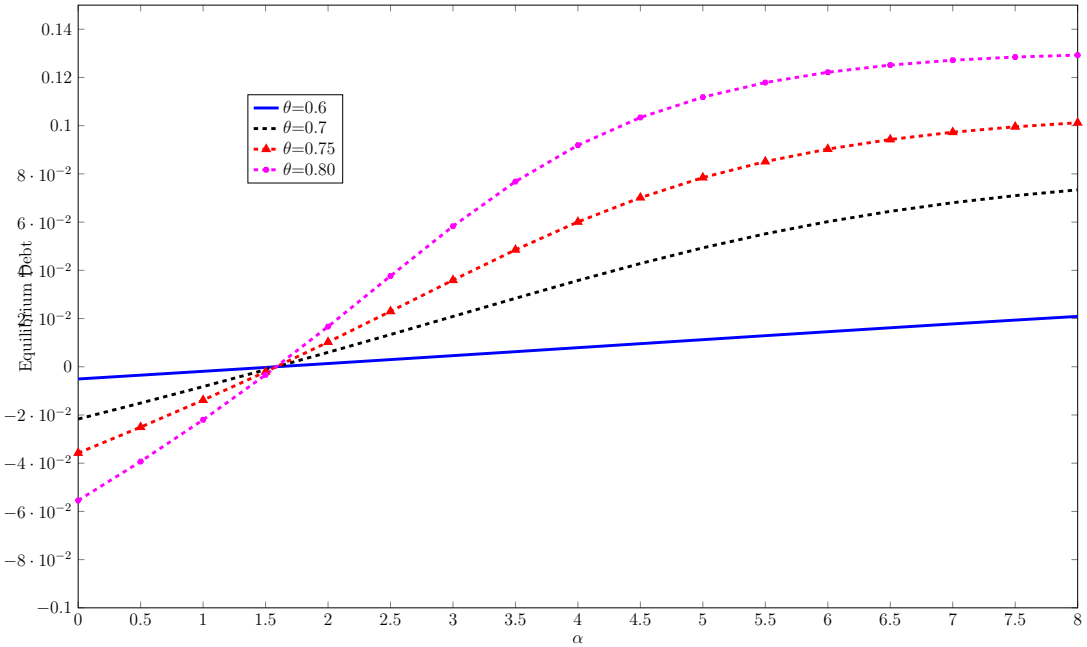
Note: In this table we report the average level of debt (in percentage) in a T-period economy, with $T = 2250$, when assuming CRRA utility function and non-linear probability, for different values of degree of retrospective voting (α, x-axis) and degree of political friction, θ. Negative values denote savings.

Figure 4 – Non-linear Probability function



Note: In this figure we display of the probability function in equation (29) for different pairs of sensitivity (α) and the level parameter (γ).

Figure 5 – Equilibrium Debt, Retrospective Voting, and Political Friction: Non-linear Probability



Note: This figure plots the equilibrium level of debt in a 2-period economy when assuming CRRA utility function and non-linear probability, for different values of degree of retrospective voting (α, x-axis) and degree of political friction, θ. The blue-solid line is associated to a low degree of political friction (θ=0.6), the black-dotted line and the red-triangle-marked line are associated to moderate degrees of political friction ((θ=0.7 and 0.8, respectively), and the pink-circle-marked line is associated to a high degree of political friction (θ=0.8).